R2D 3-5-11

Note. The S2L has slide wire pots and summing amplifier

Keep

B & K INSTRUMENTS, INC.

MODEL 1612/S2L

SPECTRUM SHAPER

B&K INSTRUMENTS, INC.
Bruel & Kjaer Precision Instruments
5111 WEST 164th STREET • CLEVELAND, OHIO 44142
September 12, 1967

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1.0 General

The 1612S filter group has been designed to provide special capabilities and features not obtainable in the standard Bruel & Kjaer Model 1612 1/3-1/1 octave filter set. A brief description of each unit is given below:

1.1 1612S1 Parallel Filter Set

A modified Bruel & Kjaer 1612C (rack mounting) 1/3-1/1 octave filter set which gives parallel 1/3 octave outputs on multi-pin rear connectors. It retains the ability to operate with Bruel & Kjaer amplifiers (2603, 2604 & 2107) to make sequential 1/3 octave and 1/1 octave analyses in conjunction with the 2305 Graphic Level Recorder. The 1612S1 includes a line operated power supply and 36 unity gain amplifiers which are mounted on six plug-in printed circuit cards on the rear of the filter set. The 1612S1 contains 33 filters with center frequencies from 25 to 40,000Hz (33 channels) can can be extended to 12.5Hz by use of the Bruel & Kjaer 1620 Extension Filter Set.

1.2 1612S1A Parallel Filter Set

Replaces the 1612S1 after serial number 171732. Operation is identical to the 1612S1 except that the 1612S1A has a single 36 channel amplifier printed circuit board wired above the scan switch. This eliminates the cabinet extension which is used on the 1612S1. The 1612S1 and 1612S1A are completely interchangeable.

1.3 1612S2L Spectrum Shaper

The 1612S2L Spectrum Shaper contains the 1612S1A Parallel Filter and the 1612 Spectrum Shaping Panel. The 1612S2L is a variable bandpass filter which has 36 1/3 octave bandpass adjustments. Thirty-three slide attenuators control the bandpass contour from 25 to 40,000Hz

center frequency and three attenuators allow the Bruel & Kjaer 1620 Extension Filter Set to be added. (center frequencies of 12.5, 16 7 20Hz) The attenuated 1/3 octave signals are summed and amplified to give unity gain through the spectrum shaper. A detachable "Memory Bar" allows the operator to "remember" the spectrum which has been set up.

The 1612S spectrum shaping panel can be used with the 1612S1 or 1612S1A to make a 1612S2L.

2.0 The 1612S1A Parallel Filter

The 1612S1A Parallel Filter Set contains 33 1/3 octave filters, 36 impedance matching amplifiers and a power supply. The circuit diagram is show in SK

Input Circuit

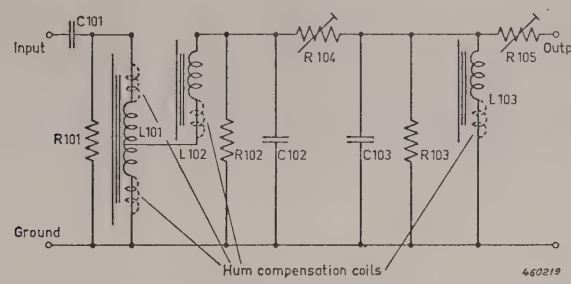
A selector and an input transformer constitutes the input circuit. The selector INPUT SWITCH has two positions. In the one position the signal is applied direct to the input of the filters and seighting networks. In the other position a step down transformer 10:1 is coupled in series with the filter and weighting network inputs. Inserting the transformer allows a higher source impedance up to 1000 Ω to be used in conjunction with the filters in relation to the 10 Ω required when the signal is applied direct. The 10 times (20dB) lower sensitivity occuring when the transformer is switched in, must be taken into consideration during measurements. To keep the megnetic flux in the filter cores below the value of saturation the voltage on the filter inputs should not be higher than 1.4 volts peak. Consequently by inserting the transformer the peak voltage on the "Filter Input" terminal can be 14 volts.

1/3 Octave Filters

The filter Set is equipped with 33 filters having center frequencies as given in the table below from which also the filter bandwidth in cycles per second can be found.

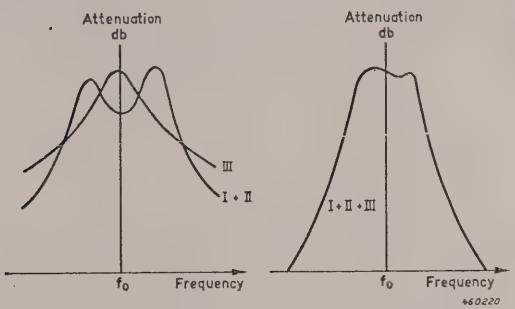
Center Frequency Hz (c/s)	Bandwidth at 3 dB Hz (c/s) Approx.	Center Frequency Hz (c/s)	Bandwidth at 3 dB Hz (c/s) Approx.
25	5.8	1000	230
31.5	7.3	1250	290
40	9.2	1600	370
50	11.6	2000	460
63	14.5	2500	580
80	18.3	3150	730
100	23	4000	920
125	29	5000	1160
160	37	6300	1450
200	46	8000	1830
250	58	10000	2300
315	73	12500	2900
400	92	16000	3700
500	116	20000	4600
630	145	25000	5800
800	183	31500	7300
		40000	9200

A single filter consists of three resonant circuits coupled together as shown in Fig. 1. The first two circuits will give rise to a two-topped frequency response, as shown in Fig. 2 left. The third gives a single top which raises the valley between the two tops. so that a resultant curve having a relatively flat band-pass and steep sides as shown in Fig. 2 right is obtained. Because the two tops do not have the same height. The third resonant frequency must be placed unsymmetrically to obtain the desired band-pass, and the resultant response curve will have



Schematic diagram of a single 1/3 octave filter unit.

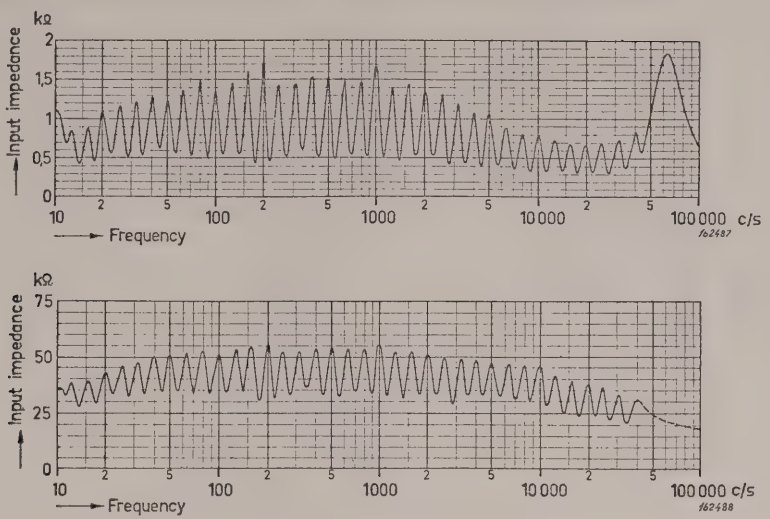
Fig. 1



Frequency characteristics illustrating the function of a 1/3 octave filter unit.

Fig. 2

humps, a broad one and a narrow one. The input impedance response of the paralleled filters, will be a wave-shaped curve, varying between approximately 500 ohms and 2000 ohms, so that the impedance is high at the center frequencies and low at the band limits (see also Fig. 3)



Typical input impedance of Band-Pass Filter Set measured on FILTER INPUT. Extension Filter Set Type 1620 has been connected. FUNCTION SELECTOR on "1/3 Octave, 0 dB" and WEIGHTING NETWORK "On".
(a) INPUT SWITCH on "Direct"
(b) INPUT SWITCH on "Transformer"

Fig. 3

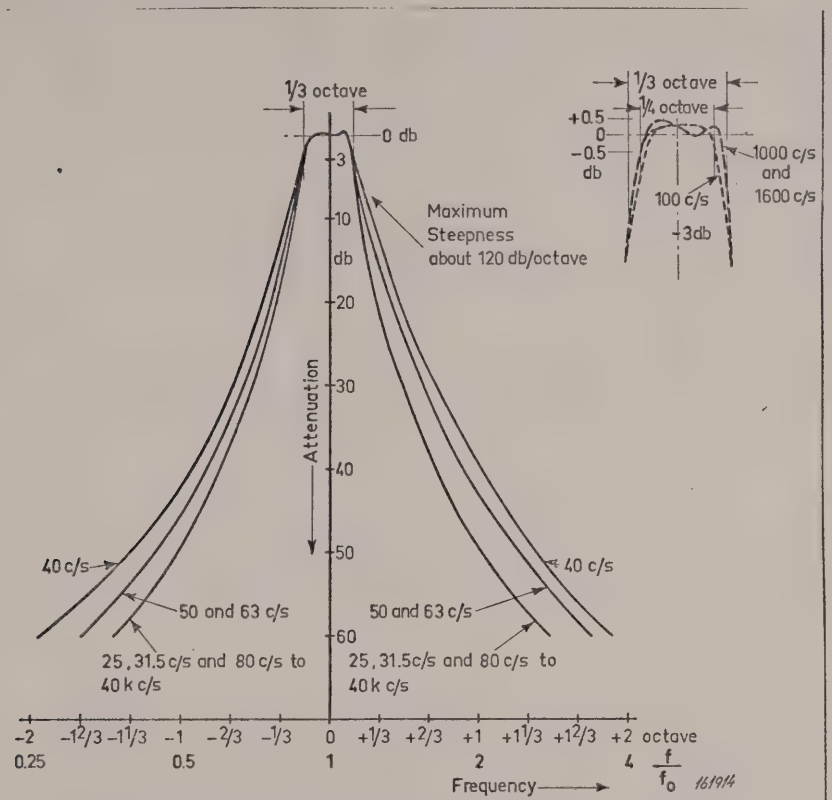
The input voltage will therefore also vary up and down if the output impedance of the input amplifier is not made low. At a source impedance of approximately 10 ohms the voltage across the filters will only vary approximately 1.5%.

To keep the transients in the filters to a minimum all the filter inputs are coupled in parallel. Furthermore, the filters are pre-loaded, and the change in load--when the Filter Switch connects the output amplifier to the different filters--is thus negligible.

Frequency Response

The frequency response of a filter is flat to within $\pm$ 1/2 dB over approximately 1/4 octave. At the band limits, i.e. 1/6 octave from the center frequency, the attenuation is approximately 3 dB. See Fig. 4. However, due to the rather steep slope of the filter curves at these points, the frequency characteristics of two neighboring filters cannot be expected to intersect exactly at the 3 dB point. This is easy to understand

because a displacing of the center frequencies of the two filters by only 1% in opposite directions will cause the intersection to take place at a



Detailed 1/3 octave filter characteristic derived from sine-wave signals.

Fig. 4

point 1.7 dB higher or lower than the 3 dB point. If the width of one filter curve is changed by 1%, the point of intersection is changed by 0.2 dB.

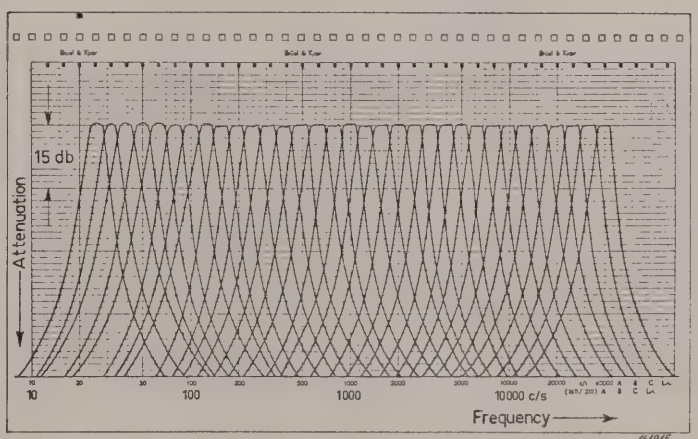
The attenuation approximately at $\pm$ 1/3 octave from the center frequency is 20 dB, and at $\pm$ 1 octave 52 dB. It has been impossible to obtain sufficiently high quality factors for the coils at some frequencies below 80 c/s without lowering the stability or making the filters larger and heavier. The filter curves will therefore not be of the same quality at these frequencies as there will be only top and the "flat" part is

about 1/6 octave wide. The attenuation of these filters is up to 4 dB at the band limits from 14 to 20 dB at ± 1/3 octave and from 42 to 50 dB at 1 octave away from the center frequency.

Effective Bandwidth

The effective bandwidth of the 1/3 octave filters is 9% greater than the bandwidth of an ideal 1/3 octave filter which transmission in the pass band is equal to that of the Filter Set when in condition "Lin." (20-45,000 Hz (c/s)). Due to tolerances in the filter production the mentioned correction of +9% to the bandwidth may be found to lie between 0% and +20%.

In some measurements it may be necessary to make a correction to the measured values because of the 9% greater bandwidth. The correction factor in dB then equals -- 0.4 dB. The deviation of this factor will, due to the production tolerances be ± 0.4 dB, which means that the greatest relative deviation will be within these limits.

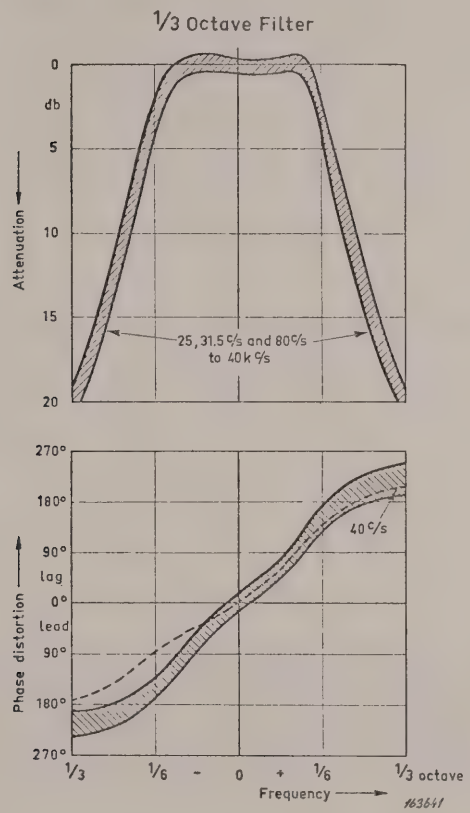


Complete set of filter characteristics when Filter Set is in 1/3 octave condition.

Fig. 5

Phase Response

Due to the nature of the filters they will cause a phase distortion which is shown in Fig. 6 together with the amplitude response of the filter top. The hatched area indicates the limits within which the different filter curves for one apparatus are expected to lie.



Phase response of Filter set in 1/3 octave condition, shown together with the respective amplitude characteristics.

Fig. 6

Hum Compensation

To reduce the induction of hum in some of the low frequency filters, occuring from magnetic fields created by nearby mains transformers or electrical machinery, the filters are provided with hum compensation

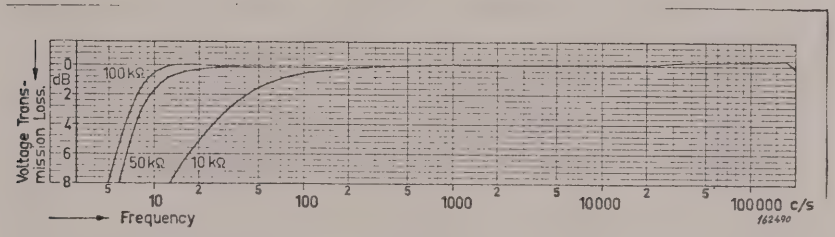
coils as seen in Fig. 1. By this means a very low hum level is obtained.

Impedance Matching Amplifiers

Thirty-six impedance matching amplifiers are mounted on a single printed circuit board inside the 1612S1A cabinet. One amplifier is wired to the output of each 1/3 octave filter and the amplifier input is loaded with 150KΩ resistor to correctly terminate the filter. The output of each amplifier is wired back to a scanning switch which allows the 1612S1A to be used for sequential 1/3 octave analysis. The output of the selector switch is fed via a further impedance matching amplifier to the output connection.

The amplifier outputs are also wired to two multi-pin connectors located on the rear of the 1612S1A. Output connections are given in SK-362.

The correct load for the impedance matching amplifiers is 50KΩ . Loads up to 10KΩ can be used with some signal loss at the low frequencies (See Fig. 7).



Typical voltage transmission loss of Filter Set as a function of frequency.

Fig. 7

Filter No.	Frequency c/s	L101,102 and 103H	C101-103nF	R101 KΩ	R102 KΩ	R103 KΩ	R104 KΩ	R105 KΩ
ZS0048	25	40	1000				300	300
ZS0049	31.5	31.5	800				"	"
ZS0029	40	25	630				"	"
	50	20	500				"	"
ZS0030	63	16	400				"	150
	80	12.5	315				"	"
ZS0031	100	10	250			300	"	"
	125	8	200			"	"	"
ZS0032	160	6.3	160					
	200	5	125	(800)		"	"	"
ZS0150	250	4	100			"	"	"
	315	3.15	80			"	"	"
ZS0151	400	2.5	63	1000		"	"	"
	500	2	50	500		"	"	"
	630	1.6	40	1000		"	"	"
	800	1.25	31.5	500		"	"	"
ZS0152	1000	1.0	25	500		150	"	"
	1250	0.8	20	300	500	"	"	"
	1600	0.63	16	"	"	"	"	"
	2000	0.5	12.5	"	"	"	"	"
ZS0153	2500	0.4	10	"	"	"	"	"
	3150	0.315	8	"	"	"	"	"
	4000	0.25	6.3	"	"	"	"	"
	5000	0.2	5	"	"	"	"	"
ZS0039	6300	0.16	4	"	"	"	"	"
	8000	0.12	3.15	"	"	"	"	"
	10000	0.1	2.5	"	"	"	"	"
	12500	0.08	2	"	"	"	"	"
	16000	0.063	1.6	"	"	"	"	"
ZS0142	20000	0.05	1.25	150	"	"	"	"
	25000	0.04	1.0	"	"	"	"	"
	315 00	0.0315	0.8	"	"	"	"	"
	40000	0.025	0.63	"	"	"	"	"

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Service Instructions
Band-Pass Filter Set

1612

Consisting of:

Filter Curves	1612.1
Weighting Network	1612.2
Level Adjustment	1612.3
Complete Adjustment	1612.4
Octave-Frequency Table	1612.5
Automatic Switching Device	1612.6
Position of Components	1612.7
Parts List	1612.8
Circuit Diagram	1612.9

Removal of the Metal Case.

After removing the four threaded retainers at the back of the instrument, it is possible to slide the chassis and the front panel out of the case.

Trouble Shooting.

If the reason for a fault is not an obvious one such as faulty transistor, broken down resistor, etc., then first test the voltages of the transistors and compare them with the voltages shown in the printed circuit (Position of components 1612.7) in order to localize the defect. Should this method of finding the fault prove unsuccessful, then check the instrument by adopting the method described in the adjustment procedure. To correct a fault in a filter the filter drawer in question must be taken out. This can be done after the leads to the drawer have been unsoldered and the two screws which hold the drawer in place removed. The drawer will be rather tight at beginning, as the other end is held firmly by a pair of springs. When the trouble has been found and remedied, the voltages and adjustments which are influenced by the remedy must be rechecked.

The tolerances stated in the instructions can only be used as a guide for adjustment and control, but any deviations must not be corrected without being sure that the tolerances of the instruments used for making the adjustment are so small as to have no influence on the measurements.

The instructions in this Manual are given purely as a guide to the service of equipment. Some faults, as f.inst. small deviations in tolerances require for their correction special control equipment and extensive experience, and in these cases it is necessary to send the instrument to the factory.

Spare Parts.

Please state type and serial number of apparatus when spare parts are ordered.

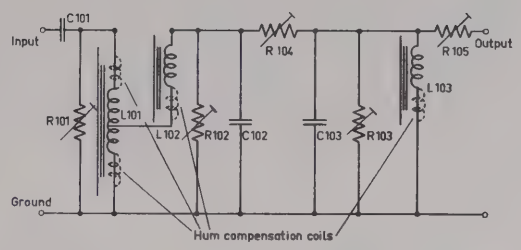
Instruments and accessories necessary for service and repair:

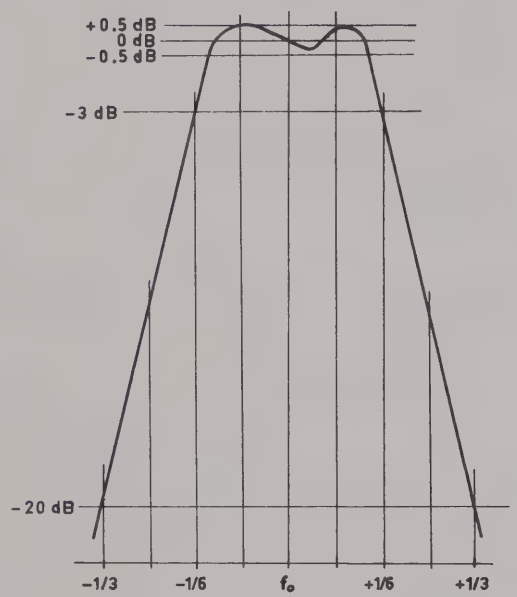
Multimeter (50 μA)
Frequency Analyzer type 2107
Beat Frequency Oscillator type 1022
(Beat Frequency Oscillator type 1013)
(Frequency Counter)
Pressure Gauge (30 - 50 gr)

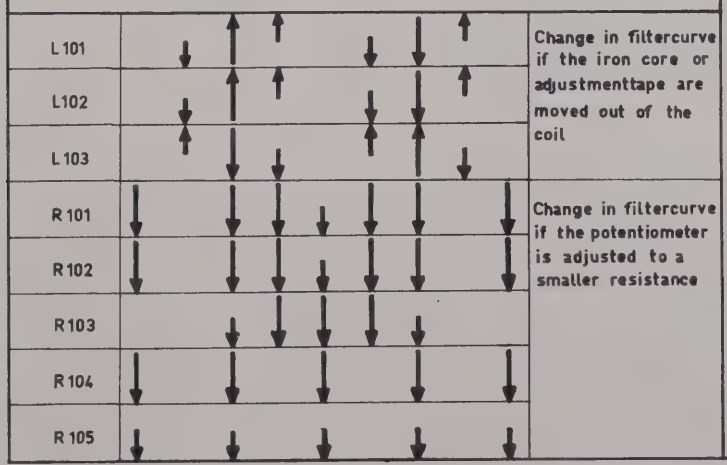
Filter Curves

valid from serial no. 64072

1/3 Octave Filter





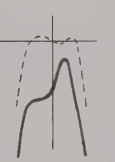


Change in filtercurve if the iron core or adjustmenttape are moved out of the coil

Change in filtercurve if the potentiometer is adjusted to a smaller resistance

Typical filtercurves for faulty filters

Correct filtercurve — 0 dB

Faulty component	Adjustment procedure	Filtercurve for faulty filter
R 104.105	1612.3	
R 101.102.103	1612.4	
C101. L101	1612.4	
C103. L103	1612.4	
L101.102.103 trimmer 'C'	1612.4	

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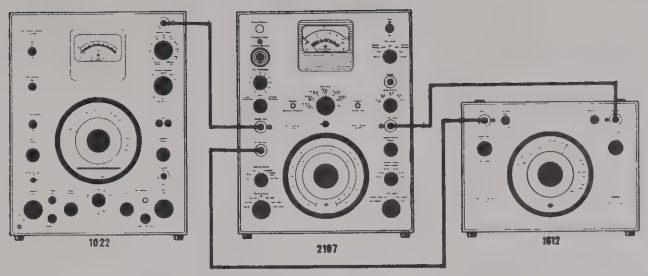
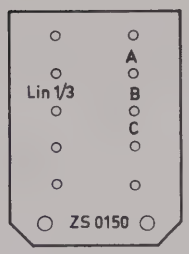
Weighting Network

1612.2

valid from serial no. 64072





2.1. Linear

a. INPUT SWITCH:"Direct"
WEIGHTING NETWORK: "On"
FILTER SWITCH: "Lin."
FUNC.SELECTOR:"1/3 Octave"

Frequency: 1000 c/s. Adjust the input voltage for an 18 dB deflection on type 2107 (RANGE MULT.:"x1" and WEIGHTING NETWORK:"Lin.2-40ooo c/s")

Change WEIGHTING NETWORK on type 2107 to "Ext. Filter".
Change frequency to 50 c/s.
Deflection on type 2107: 17.8 - 18.2 dB.
If necessary adjust R 99 "Lin. 1/3"

Possible reasons for fault: defective transistor V1, V2
defective zener diode Q1.

d.c.voltage for transistor amplifier: Q1: approx. 12 V
V2 emitter: approx. 5 V
base: approx. 4.8 V.

Vary the frequency from 20-20ooo c/s.
Deflection on type 2107: 18 dB
Tolerance: ± o.3 dB (+ tolerance of type 1022: o.3 dB and type 2107: o.2 dB)

b. FUNC.SELECTOR to "1/1 Octave"

Vary the frequency from 20 - 20ooo c/s.
Deflection on type 2107: 18 dB (RANGE MULT.: "x o.3").
Tolerance: ± o.6 dB (+ tolerance of type 1022: o.3 dB and type 2107: o.2 dB)
If necessary change value of C 91 or R 88.

2.2. A-B-C Curves

a. INPUT SWITCH: "Direct"
WEIGHTING NETWORK: "On"
FILTER SWITCH: "Lin."
FUNC.SELECTOR:"1/3 Octave"

Frequency: 1000 c/s. Adjust the input voltage for an 18 dB deflection on type 2107 (RANGE MULT.:"x1" and WEIGHTING NETWORK: "Lin.2-40ooo c/s")

Change WEIGHTING NETWORK on type 2107 to "Ext. Filter".

b. FILTER SWITCH to curve A

Deflection on type 2107: 17.7 - 18.3 dB.
If necessary adjust R 98 "A".

c. FILTER SWITCH to curve B

Deflection on type 2107: 17.7 - 18.3 dB.
If necessary adjust R 97 "B".

d. FILTER SWITCH to curve C

Deflection on type 2107: 17.7 - 18.3 dB.
If necessary adjust R 94 "C".

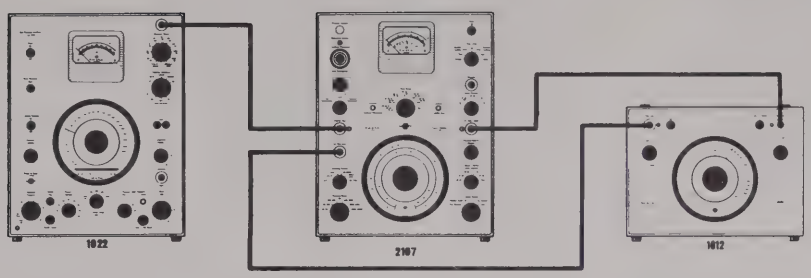
e.

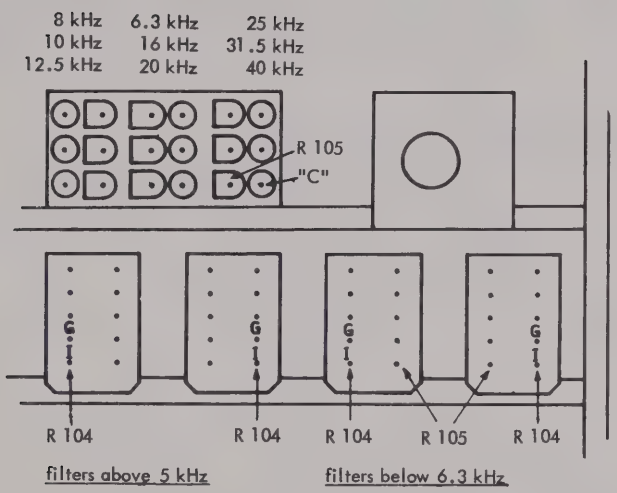
Whenever R 94, 97, 98 is adjusted item e should be checked as the settings of these potentiometers influence each other.

	Curve "A"		Curve "B"		Curve "C"	
Frequency c/s	Defl. on type 2107 dB	RANGE MULT.	Defl.on type 2107 dB	RANGE MULT.	Defl. on type 2107 dB	RANGE MULT.
20	4.6 - 12.6	X o.01	10.6 - 18.6	X o.1	8.7 - 16.7	X 1
63	10.4 - 13.9	X o.1	7.1 - 10.6	X 1	15.7 - 19.2	X 1
500	14.4 - 15.2	X 1	17.3 - 18.1	X 1	17.6 - 18.4	X 1
1000	17.7 - 18.3	X 1	17.7 - 18.3	X 1	17.7 - 18.3	X 1
2000	19.0 - 19.4	X 1	17.6 - 18.0	X 1	17.6 - 18.0	X 1
8000	15.7 - 17.4	X 1	13.8 - 15.5	X 1	13.8 - 15.5	X 1
20000	6.8 - 10.3	X 1	15.0 - 18.5	X o.3	14.9 - 18.4	X o.3

Level Adjustment

valid from serial no. 64072





3.1. 1/3 Octave Filter

a. INPUT SWITCH: "Direct"
FUNC.SELECTOR: "1/3 Octave"
WEIGHTING NETWORK: "On"

Set the frequency to the center frequency of the filter and adjust the input voltage for an 18 dB deflection on type 2107 (RANGE MULT .:"X1" and WEIGHTING NETWORK: "Lin. 2-40ooo c/s").

Change WEIGHTING NETWORK on type 2107 to "Ext.Filter".

b. FILTER SWITCH in required position 25-5ooo c/s

Vary the frequency around the center frequency of the filter and check the filter curve.
Deflection on type 2107: 18.0 - 18.5 dB for the tops
17.5 - 18.0 dB for the valleys

If necessary adjust R104 or R105.
Change frequency to + and - 1/6 octave.
Deflection on type 2107: approx. 15 dB.
After adjustment of R104-105, check 3.2

c. FILTER SWITCH in required position 6300 - 16ooo c/s

As under item b but adjust the valleys by means of R104 or R105 and the tops by means of trimmer "C".

d. FILTER SWITCH in required position 20ooo - 40ooo c/s

Check of these filters requires use of a high frequency oscillator f.inst. type 1013.

Check and tolerances as under item c.

3.2. 1/1 Octave Filter

a. INPUT SWITCH: "Direct"
FUNC. SELECTOR: "1/1 Octave"
WEIGHTING NETWORK: "On"

Set frequency to the center frequency of the filter and adjust the input voltage for an 18 dB deflection on type 2107 (RANGE MULT.:"X1" and WEIGHTING NETWORK :" Lin. 2-40ooo c/s)

Change WEIGHTING NETWORK on type 2107 to "Ext.Filter" and RANGE MULT. to "Xo.3".

b. FILTER SWITCH in required position
31.5 - 63 c/s

Vary the frequency around the center frequency of the filter.

Deflection on type 2107: 18 - 20 dB for the tops
16 - 18 dB for the valleys

Change frequency to + and - 1/2 octave.
Deflection on type 2107: approx. 15 dB

If necessary to adjust the filter. Set the frequency at the point where the deflection exceeds the tolerance and note the deviation from 18 dB deflection on type 2107.

Change FUNC.SELECTOR to "1/3 Octave" and turn the FILTER SWITCH to the defect 1/3 octave filter, indicated by the greatest deflection on type 2107 (RANGE MULT.: "X1")

Change frequency to the center frequency of the defect filter and adjust the deflection on type 2107 by means of R104 to the deviation just noted from 18 dB deflection, but in opposite direction.

Then adjust R105 for a deflection on type 2107: 17.5-18.0 dB and repeat item b.

c. FILTER SWITCH in required position
125-8ooo c/s

Adjustment as under item b,
but deflection on type 2107: 18 - 19 dB for the tops
17 - 18 dB for the valleys.

d. FILTER SWITCH in required position
16ooo - 31ooo c/s

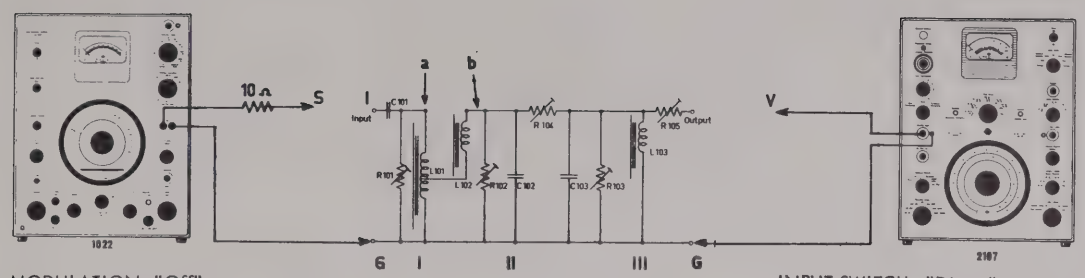
Adjustment of these filters requires use of a high frequency oscillator f.inst. type 1013.

Adjustment and tolerances as under item c.

Complete Adjustment

1612.4

valid from serial no. 64072



MODULATION: "Off"
COMPRESSOR: "Off"
MATCHING IMP.: "6Ω"

INPUT SWITCH: "Direct"
WEIGHTING NETWORK: "Lin 2-40ooo"
METER SWITCH: "RMS. fast"
FUNC. SELECTOR: "Selec. Section Off"

Before adjustment turn potentiometer R101-2-3 to mid. position R104 to max. resistance and R105 to min. resistance.

4.1. Adjustment of Resonant Circuit I and II

a. Reference adj.

Connect: S and V to point I
b to point G

Set the frequency to the center frequency of the filter and adjust the input voltage for an 18 dB deflection on type 2107 (RANGE MULT.:"x1" and METER RANGE: "1 V").

b. Adj.of resonant frequency L 101.

Change V to point a.

Change frequency to approx. 1% above the center frequency of the filter and adjust L 101 to max. deflection on type 2107.

c. Adj. of Q. R 101.

Adjust R101, if any (some of the low frequency filters have no R101), for a 19 dB deflection on type 2107 (RANGE MULT.:"x1" and METER RANGE "10 V")

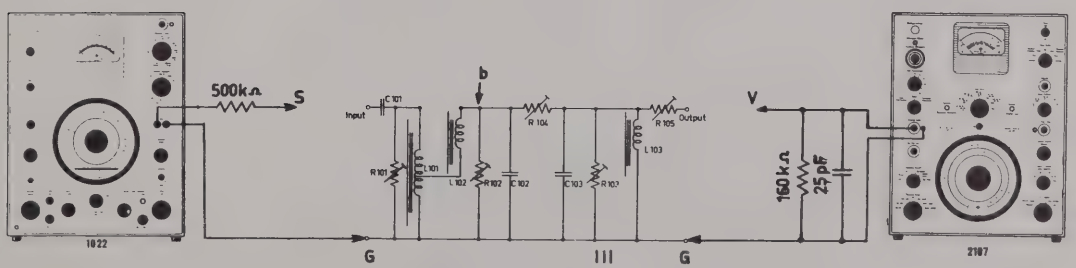
d. Adj. of resonant frequency L 102.

Connect: S to point a.
V to point b.
Filter output to point G.

Adjust L102 to max. deflection on type 2107 at the same frequency as under item b.

e. Adj. of Q. R102

Adjust R102, if any (some of the low frequency filters have no R102), for a 10 dB deflection on type 2107 (RANGE MULT.:"x o.3" and METER RANGE: "10 V".)



4.2. Adjustment of Resonant Circuit III

a. Reference Adj.

Connect: S to V.

Set the frequency to the center frequency of the filter and adjust the input voltage for an 18 dB deflection on type 2107 (RANGE MULT.:"x1" and METER RANGE: "1V").

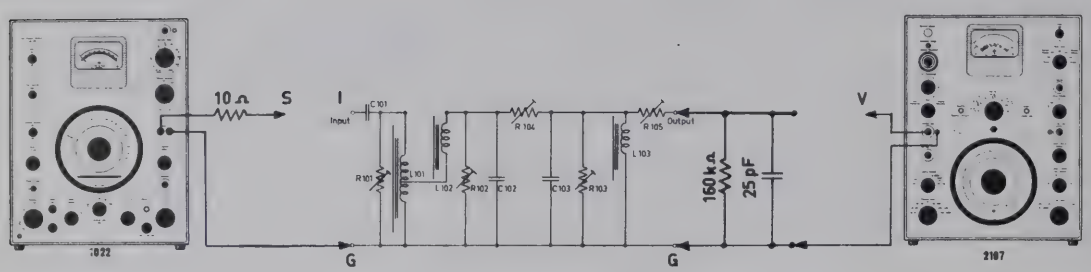
b. Adj. of resonant frequency. L 103.

Connect: S and V to filter output
b to point G

Set the frequency to approx. 1% below the center frequency of the filter and adjust L103 to max. deflection on type 2107.

c. Adj. of Q R 103.

Adjust R103, if any (some of the low frequency filters have no R103), for a 10 dB deflection on type 2107 (RANGE MULT.:"x o.3" and METER RANGE: "1 V").



Adjustment of attenuation at ± 1/6 and ± 1/3 octave requires use of a frequency counter connected to type 1022 as the accuracy of the frequency should be within o.1 - o.2%.

4.3. Adjustment of Filter Curve

a. Reference adj.

Connect: V and S to point I

Set frequency to the center frequency of the filter and adjust the input voltage for an 18 dB deflection on type 2107 (RANGE MULT.:"x 1" and METER RANGE: "1 V").

b. Filter tops and valleys

Change V to filter output.

Vary the frequency around the center frequency of the filter.
Average deflection on type 2107: 18 dB.
If necessary adjust R104.

check that the 2 tops have the same height.
If necessary adjust L103.

Check the deflection on type 2107: 18.0-18.5 dB for the tops
17.5-18.0 dB for the valleys
If necessary adjust R103 (or R101-2)

c. Attenuation at ± 1/3 octave.

Check that the attenuation at ± 1/3 octave is equal.

Attenuation: Filters below 1000 c/s approx. 18 dB
Filters above " " 20 dB

If necessary adjust L101-2-3 in the same direction.

d. Attenuation at ± 1/6 octave

Check that the attenuation at ± 1/6 octave is equal.
Attenuation: approx. 3 dB
If necessary adjust L101-2-3 in the same direction.

After adjustment mount the filter drawer in type 1612 and check the filter according to 1612.3.

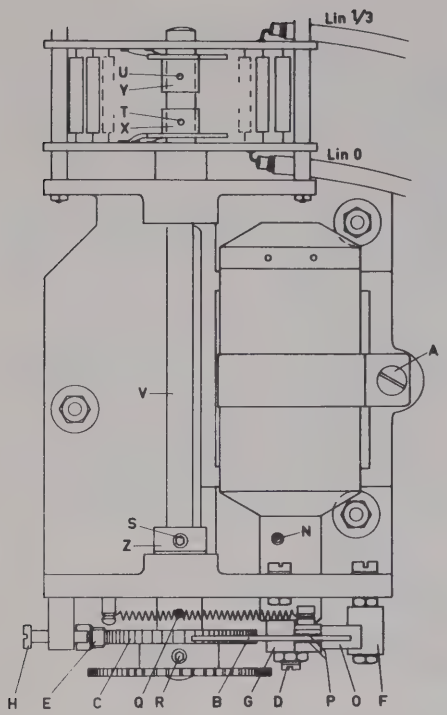
Octave-Frequency Table

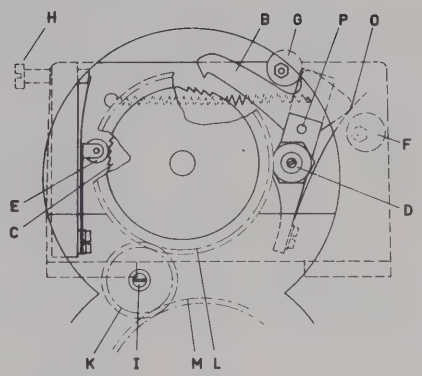
1612.5

- octave			center frequency	+ octave		
1/2	1/3	1/6	c/s	1/6	1/3	1/2
	10.00	11.22	12.5	14.13	15.85	
11.22	12.59	14.13	16	17.78	19.95	22.40
	15.85	17.78	20	22.40	25.10	
	19.95	22.40	25	28.20	31.60	
22.40	25.10	28.20	31.5	35.50	39.80	44.70
	31.60	35.50	40	44.70	50.10	
	39.80	44.70	50	56.20	63.10	
44.70	50.10	56.20	63	70.80	79.40	89.10
	63.10	70.80	80	89.10	100.0	
	79.40	89.10	100	112.2	125.9	
89.10	100.0	112.2	125	141.3	158.5	177.8
	125.9	141.3	160	177.8	199.5	
	158.5	177.8	200	224.0	251.0	
177.0	199.5	224.0	250	282.0	316.0	355.0
	251.0	282.0	315	355.0	398.0	
	316.0	355.0	400	447.0	501.0	
355.0	398.0	447.0	500	562.0	631.0	708.0
	501.0	562.0	630	708.0	794.0	
	631.0	708.0	800	891.0	1000	
708.0	794.0	891.0	1000	1122	1259	1413
	1000	1122	1250	1413	1585	
	1259	1413	1600	1778	1995	
1413	1585	1778	2000	2240	2510	2820
	1995	2240	2500	2820	3160	
	2510	2820	3150	3550	3980	
2820	3160	3550	4000	4470	5010	5620
	3980	4470	5000	5620	6310	
	5010	5620	6300	7080	7940	
5620	6310	7080	8000	8910	10000	11220
	7940	8910	10000	11220	12590	
	10000	11220	12500	14130	15850	
11220	12590	14130	16000	17780	19950	22400
	15850	17780	20000	22400	25100	
	19950	22400	25000	28200	31600	
22400	25100	28200	31500	35500	39800	44700
	31600	35500	40000	44700	50100	

Automatic Switching Device 1612.6

valid from serial no. 64072





6.1. Mechanical Adjustment

a. Max. operating power

Operate the FILTER SWITCH automatically, by means of pulses from a Level Recorder Type 2305 or an external DC supply (24 V, 180 mA) in series with a switch, connected to REMOTE CONTROL jack. (+ should be connected to pin 2 and - to pin 1).

Loosen screw A and rotate the motor until max. operating power is obtained.

Before retightening screw A check that the pawl B is located in the middle of the pawl wheel C.

b. Pawl mechanism

Turn the motor axle D clockwise to its limit. Check that the spring loaded locking roll E is in a position between 2 teeth on the pawl wheel C. If not loosen the nut and turn the eccentric nylon bush F to the correct position. After adjustment carefully retighten the nut.

Turn the motor axle D slowly clockwise and check the movement of the pawl B. The pawl should first move down to the pawl wheel C on a point between 2 teeth and then turn the pawl wheel one position. If not, loosen the nut and turn the eccentric nylon bush G to the correct position.
After adjustment carefully retighten the nut.

Replace the frequency pointer and the bakelite knob.

Adjust the spring load on locking roll E by means of screw H. The movement of the FILTER SWITCH should be smooth but the screw should be tightened so that the pressure can overcome the friction in the switch and move the pawl wheel back again if it is left a little out of locking position.

Operate the FILTER SWITCH automatically as under item a and check that the switching is stable, if not readjust screw H.

c. Play in the frequency pointer.

Loosen screw I and tighten it again in a position where the play between the nylon wheel K and both the metal wheels L and M is small, but without any point where the wheels are moved with force.

d. Lubricating

Apply a little thin non-acidic machine oil (e.g. sewing machine oil) only to the following parts: Motor, point N

Switching axle, point Q

Pawl mechanism, point O, P

6.2. 50 Position Switch

Remove the protecting tape from the left side of the switch.

a. Cleaning

Loosen screws R-S-T-U and pull out axle V far enough so that the rotary contacts X-Y are free.

Carefully clean the fixed and rotary contacts with a soft cloth and trichlorethylene.

b. Contact Pressure

After cleaning replace the rotary contacts X-Y and axle V, tighten the pawl wheel C and stop-bush Z in a position which allows only a slight play in the axial direction.

Adjust the rotary contacts X-Y along the axle for a contact pressure of 30-40 gr. and tighten screws T-U.

c. Check of Switch

Connect an ohmmeter across the core in the coax cable "Lin.1/3" and the green lead connected to soldering tag "Lin. 1/3" on filter drawer ZS 0150 and turn the FILTER SWITCH to a position where the resistance is 0.

Replace the frequency scale and fix the pointer in position "Lin."

Check that the rotary contact Y is placed on the axle V in relation to the pawl wheel so that it gives contact symmetrically around the locking position. If not loosen screw U and correct the position of the rotary contact.

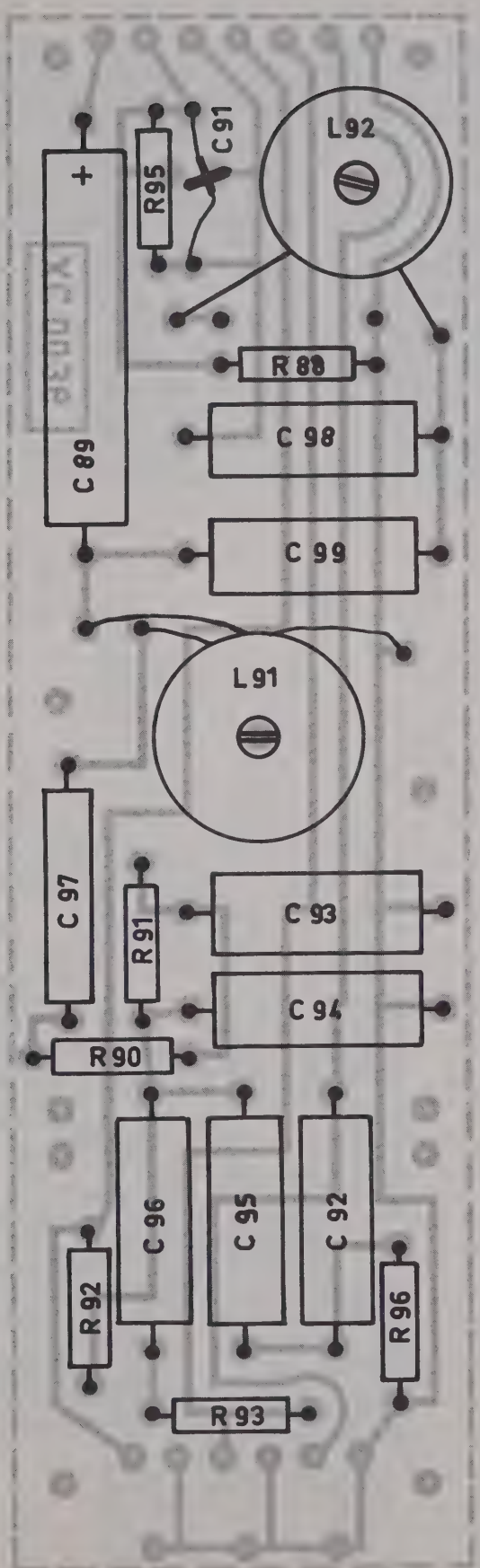
After adjustment recheck contact pressure.

Connect the ohmmeter across the core in the coax cable "Lin.0" and the red lead connected to soldering tag "Lin.0" on filter drawer ZS 0150. Set the FILTER SWITCH to "Lin."

Check the rotary contact X in the same way as rotary contact Y.

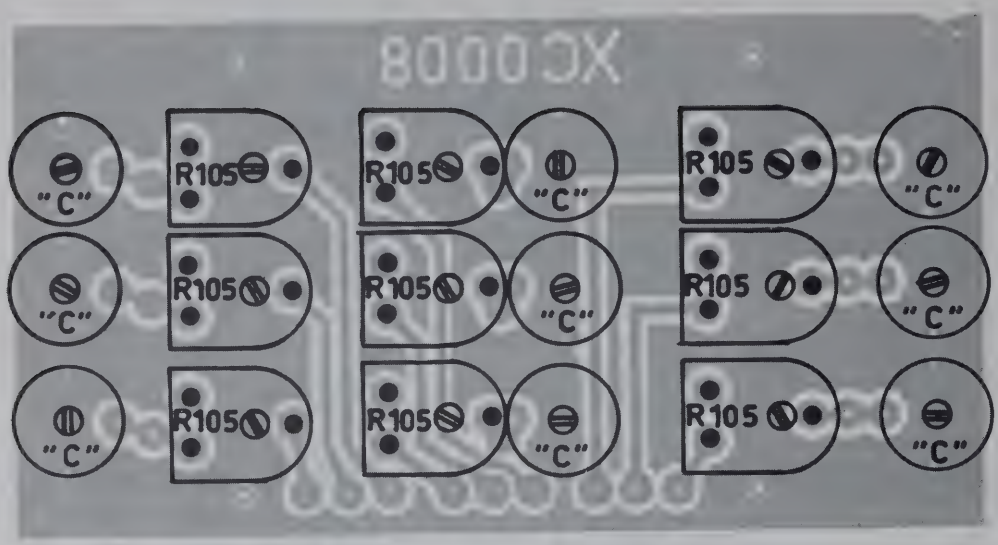
Position of Components

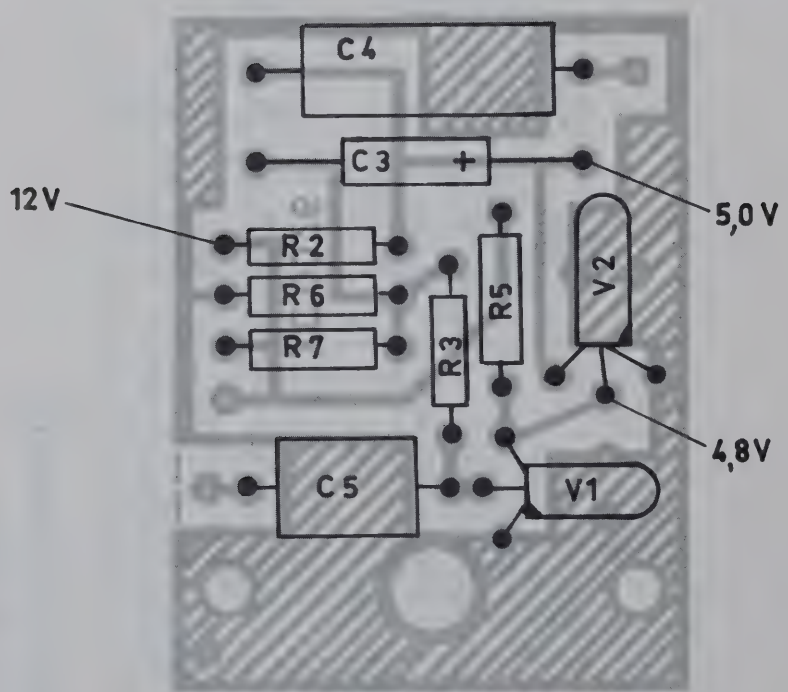
valid from serial no. 64072



Lin 1/1 – 1/3 octave

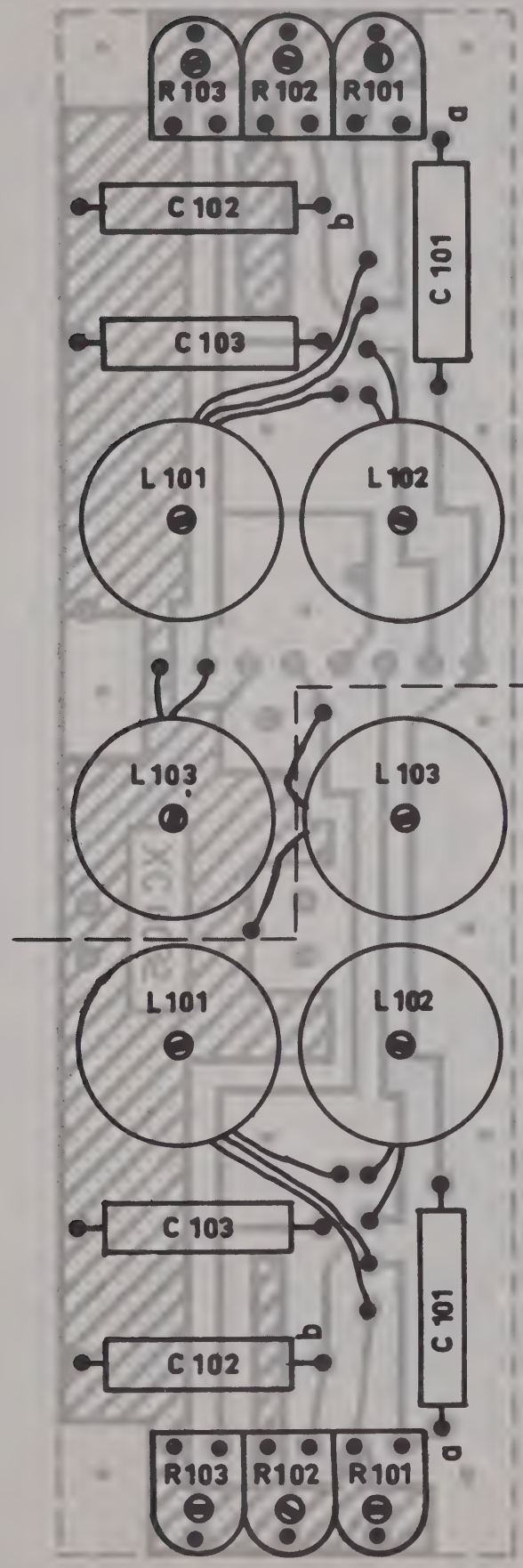
Weighting Network
curve A–B–C


"C"
R105


C4
C3
+
12V
5,0V
R2
R6
R7
R3
R5
V2
4,8V
C5
V1

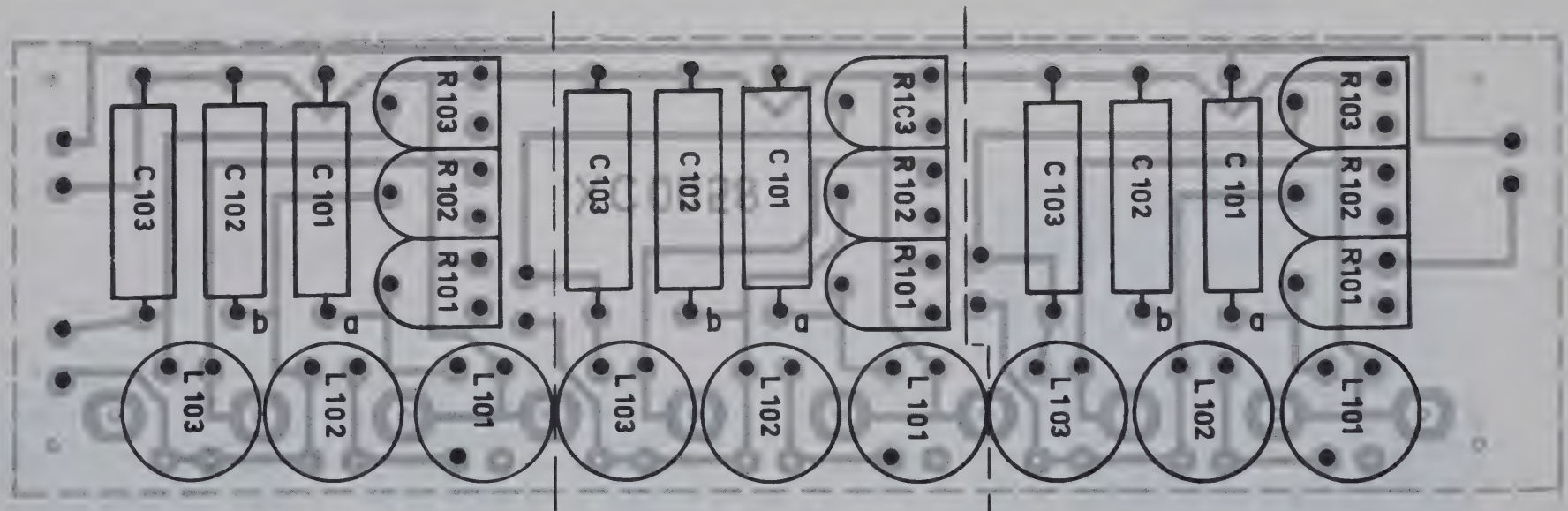
Position of Components

valid from serial no. 64072



Filter: 315 c/s
400 c/s
800 c/s
1kc/s
2k c/s
4k c/s
5kc/s

Filter: 250 c/s
500 c/s
630 c/s
1,25kc/s
1,6 kc/s
2,5 kc/s
3,15kc/s



Filter: 6,3 kc/s
16 kc/s
40 kc/s

Filter: 8 kc/s
12,5 kc/s
20 kc/s
31,5 kc/s

Filter: 10 kc/s
25 kc/s

COMPONENT TYPE		STOCK REFERENCE		CIRCUIT DIAGRAM
Instruction manual		BB	1612	
Cable for battery (1612)		AQ	0008	
Remote control cable (2305)		AQ	0002	
CAPACITORS:				
Electrolytic	40 µF/170 V	CE	2038	C 1
"	25 µF/ 50 V	CE	8948	C 2
"	10 µF/ 6 V	CE	0001	C 3
Polyester	0.1 µF/125 V	CS	0013	C 5
"	0.47 µF/125 V	CS	0021	C 4
RESISTORS:				
Carbon film	1/3 W ± 10%	RK	12.5 kΩ	R 1
"	" "	RK	25 kΩ	R 2
"	" "	RK	50 kΩ	R 3
"	" "	RK	100 kΩ	R 4
"	" "	RK	200 kΩ	R 5
"	" "	RK	300 kΩ	R 6
"	" "	RK	500 kΩ	R 7
"	" "	RK	2 MΩ	R 8
"	" "	RK	250 Ω	R 107
"	1/2 W ± 10%	RK	425 kΩ	R 117-120
MISCELLANEOUS:				
Rubber foot		DF	7010	
Coaxial jack		JJ	0013	
7-pole jack		JJ	0018	
6-pole jack		JJ	4704	
Coaxial plug		JP	0018	
Mechanical adaptor		JP	0019	
Ground jack		JT	6204	
Case, wood		KA	0012	
Case, metal		KQ	0010	
Input switch		NN	0564	O 1
Weighting network switch		NN	0567	O 5
Function selector		OR	1611	O 2
Automatic switching		OZ	1016	O 4
Zener diode	12 V ± 10%	QV	1312	Q 1
Germanium diode	OA 85	QV	0085	Q 13
Frequency dial		SA	0206	
Bakelite knob	30 Ø	SN	0814	
"	54 Ø	SN	3810	
"	30 Ø twin marking	SN	0816	
Pointer for frequency dial		SV	0015	
Auto-transformer		TQ	0002	T
Transistor	OC 44. selected	VB	1044	V 1
"	" "	VB	2044	V 2
Printed wiring for transistor ampl.		XC	0026	
" "	weighting network	XC	0036	
" "	filter	XC	0035	
" "	"	XC	0058	
" "	"	XC	0008	
WEIGHTING NETWORK:				
Capacitors:				
Electrolytic	40 µF/150 V	CE	2038	C 89
"	2 µF/ 50 V	CE	2648	C 99
Ceramic	5 pF/500 V	CK	0034	C 90
Polystyrene	3.16 nF ± 2%/200 V	CT	3127	C 94
"	4 nF ± 2%/200 V	CT	3325	C 92,93,95
"	6.3 nF ± 2%/200 V	CT	3346	C 96
"	63 nF ± 2%/100 V	CT	3130	C 97,98

COMPONENT		STOCK REFERENCE		CIRCUIT DIAGRAM
Auto-transformer		LB	0017	L 91
Coil	50 H	LB	0431	L 92
POTENTIOMETERS:				
Trimmer pot.m.	150 kΩ lin.	PG	4151	R 94
"	1 MΩ lin.	PG	5102	R 97-99
RESISTORS:				
Carbon film	1/3 W ± 5%	RK	400 Ω	R 89
"	1/3 W ± 2%	RK	3.15 kΩ	R 90,91
"	" "	RK	14 kΩ	R 92
"	" "	RK	32 kΩ	R 93
"	" "	RK	160 kΩ	R 95,96
1/3 OCTAVE FILTERS:				
FILTER 12,5 c/s:				
Polyester	1 µF ± 10%/250V	CS	0025	C 101-103
Trimmer pot.m.	300 kΩ lin.	PG	4300	R 103,105
" "	250 kΩ lin.	PG	4250	R 104
Coil	80 H	LB	0504	L 102,103
"	80 H	LB	0505	L 101
FILTER 16 c/s:				
Polyester	1 µF ± 10%/250V	CS	0025	C 101-103
"	0.68 µF ± 10%/250V	CS	0023	C 101-103
Trimmer pot.m.	300 kΩ	PG	4300	R 103, 105
"	250 kΩ	PG	4250	R 104
Coil	63 H	LB	0502	L 102,103
"	63 H	LB	0503	L 101
FILTER 20 c/s:				
Polyester	1 µF ± 10%/250V	CS	0025	C 101-103
"	0.22 µF ± 10%/250V	CS	0017	C 101-103
Trimmer pot.m.	300 kΩ lin.	PQ	4300	R 103,105
"	250 kΩ lin.	PQ	4250	R 104
Coil	50 H	LB	0501	L 101
"	50 H	LB	0500	L 102,103
FILTER 25 c/s:				
Polyester	1 µF ± 10%/250V	CS	0025	C 101-103
Trimmer pot.m.	300 kΩ lin.	PG	4301	R 104,105
Coil	40 H	LB	0104	L 102,103
"	40 H	LB	0103	L 101
FILTER 31.5 c/s:				
Polyester	330 nF ± 10%/250V	CS	0019	C 101-103
"	470 nF ± 10%/250V	CS	0021	C 101-103
Trimmer pot.m.	300 kΩ lin.	PG	4301	R 104,105
Coil	31.5 H	LB	0106	L 102,103
"	31.5 H	LB	0107	L 101
FILTER 40 c/s:				
Polystyrene	630 nF ± 5%/100V	CT	6106	C 101-103
Trimmer pot.m.	300 kΩ lin.	PG	4301	R 104,105
Coil	25 H	LB	0408	L 102,103
"	25 H	LB	0409	L 101
FILTER 50 c/s:				
Polystyrene	500 nF ± 5%/100V	CT	6107	C 101-103
Trimmer pot.m.	300 kΩ lin.	PG	4301	R 104,105
Coil	20 H	LB	0410	L 102,103
"	20 H	LB	0411	L 101

COMPONENT TYPE		STOCK REFERENCE		CIRCUIT DIAGRAM
FILTER 63 c/s:				
Polystyrene	400 nF ± 5%/100 V	CT	6104	C 101-103
Trimmer pot.m.	150 kΩ lin.	PG	4151	R 105
"	300 kΩ lin.	PG	4301	R 104
Coil	16 H	LB	0412	L 102,103
"	16 H	LB	0413	L 101
FILTER 80 c/s:				
Polystyrene	320 nF ± 5%/100 V	CT	6105	C 101-103
Trimmer pot.m.	150 kΩ lin.	PG	4151	R 105
"	300 kΩ lin.	PG	4301	R 104
Coil	12.5 H	LB	0414	L 102,103
"	12.5 H	LB	0415	L 101
FILTER 100 c/s:				
Polystyrene	250 nF ± 5%/100 V	CT	6102	C 101-103
Trimmer pot.m.	150 kΩ lin.	PG	4151	R 105
"	300 kΩ lin.	PG	4300	R 103
"	300 kΩ lin.	PG	4301	R 104
Coil	10 H	LB	0116	L 102,103
"	10 H	LB	0117	L 101
FILTER 125 c/s:				
Polystyrene	200 nF ± 5%/100 V	CT	6103	C 101-103
Trimmer pot.m.	150 kΩ lin.	PG	4151	R 105
"	300 kΩ lin.	PG	4300	R 103
"	300 kΩ lin.	PG	4301	R 104
Coil	8 H	LB	0118	L 102,103
"	8 H	LB	0119	L 101
FILTER 160 c/s:				
Polystyrene	160 nF ± 5%/100 V	CT	6101	C 101-103
Trimmer pot.m.	150 kΩ lin.	PG	4151	R 105
"	300 kΩ lin.	PG	4300	R 103
"	300 kΩ lin.	PG	4301	R 104
Coil	6.3 H	LB	0120	L 102,103
"	6.3 H	LB	0121	L 101
FILTER 200 c/s:				
Polystyrene	125 nF ± 5%/100 V	CT	6100	C 101-103
Trimmer pot.m.	800 kΩ lin.	PG	5101	R 101
"	300 kΩ lin.	PG	4300	R 103
"	300 kΩ lin.	PG	4301	R 104
"	150 kΩ lin.	PG	4151	R 105
Coil	5 H	LB	0122	L 102,103
"	5 H	LB	0123	L 101
FILTER 250 c/s:				
Polystyrene	100 nF ± 5%/100 V	CT	3433	C 101-103
Trimmer pot.m.	300 kΩ lin.	PG	4301	R 103,104
"	150 kΩ lin.	PG	4151	R 105
Coil	4 H	LB	0429	L 102,103
"	4 H	LB	0430	L 101
FILTER 315 c/s:				
Polystyrene	80 nF ± 5%/100 V	C1	3432	C 101-103
Trimmer pot.m.	300 kΩ lin.	PG	4301	R 103,104
"	150 kΩ lin.	PG	4151	R 105
Coil	3.16 H	LB	0427	L 102,103
"	3.16 H	LB	0428	L 101

COMPONENT		STOCK REFERENCE		CIRCUIT DIAGRAM
FILTER 400 c/s:				
Polystyrene	63 nF ± 5%/100 V	CT	3431	C 101-103
Trimmer pot.m.	500 kΩ lin.	PG	4502	R 101
"	300 kΩ lin.	PG	4301	R 103, 104
"	150 kΩ lin.	PG	4151	R 105
Coil	2.5 H	LB	0419	L 102,103
"	2.5 H	LB	0420	L 101
FILTER 500 c/s:				
Polystyrene	50 nF ± 5%/100 V	CT	3430	C 101-103
Trimmer pot.m.	500 kΩ lin.	PG	4502	R 101
"	300 kΩ lin.	PG	4301	R 103,104
"	150 kΩ lin.	PG	4151	R 105
Coil	2 H	LB	0421	L 102,103
"	2 H	LB	0422	L 101
FILTER 630 c/s:				
Polystyrene	40 nF ± 5%/100 V	CT	3239	C 101-103
Trimmer pot.m.	1 MΩ lin.	PG	5102	R 101
"	300 kΩ lin.	PG	4301	R 103,104
"	150 kΩ lin.	PG	4151	R 105
Coil	1.6 H	LB	0423	L 102,103
"	1.6 H	LB	0424	L 101
FILTER 800 c/s:				
Polystyrene	31.5 nF ± 5%/100 V	CT	3238	C 101-103
Trimmer pot.m.	1 MΩ lin.	PG	5102	R 101
"	300 kΩ lin.	PG	4301	R 103,104
"	150 kΩ lin.	PG	4151	R 105
Coil	1.25 H	LB	0425	L 102,103
"	1.25 H	LB	0426	L 101
FILTER 1 k c/s:				
Polystyrene	25 nF ± 5%/100 V	CT	3237	C 101-103
Trimmer pot.m.	300 kΩ lin.	PG	4301	R 101,104
"	500 kΩ lin.	PG	4502	R 102
"	150 kΩ lin.	PG	4151	R 103,105
Coil	1 H	LB	0440	L 102,103
"	1 H	LB	0441	L 101
FILTER 1.25 k c/s:				
Polystyrene	20 nF ± 5%/200 V	CT	3230	C 101-103
Trimmer pot.m.	300 kΩ lin.	PG	4301	R 101,104
"	500 kΩ lin.	PG	4502	R 102
"	150 kΩ lin.	PG	4151	R 103, 105
Coil	800 mH	LB	0442	L 102,103
"	800 mH	LB	0443	L 101
FILTER 1.6 k c/s:				
Polystyrene	16 nF ± 5%/100 V	CT	3236	C 101-103
Trimmer pot.m.	300 kΩ lin.	PG	4301	R 101,104
"	500 kΩ lin.	PG	4502	R 102
"	150 kΩ lin.	PG	4151	R 103,105
Coil	640 mH	LB	0444	L 102,103
"	640 mH	LB	0445	L 101
FILTER 2 k c/s:				
Polystyrene	12.5 nF ± 5%/200 V	CT	3235	C 101-103
Trimmer pot.m.	300 kΩ lin.	PG	4301	R 101,104
"	500 kΩ lin.	PG	4502	R 102
"	150 kΩ lin.	PG	4151	R 103,105
Coil	500 mH	LB	0446	L 102,103
"	500 mH	LB	0447	L 101

COMPONENT TYPE		STOCK REFERENCE		CIRCUIT DIAGRAM
FILTER 2.5 k c/s:				
Polystyrene	10 nF ± 5%/200 V	CT	3228	C 101-103
Trimmer pot.m.	300 kΩ lin.	PG	4301	R 101,104
"	500 kΩ lin.	PG	4502	R 102
"	150 kΩ lin.	PG	4151	R 103,105
Coil	400 mH	LB	0432	L 102,103
"	400 mH	LB	0433	L 101
FILTER 3.15 k c/s:				
Polystyrene	8 nF ± 5%/200 V	CT	3227	C 101-103
Trimmer pot.m.	300 kΩ lin.	PG	4301	R 101,104
"	500 kΩ lin.	PG	4502	R 102
"	150 kΩ lin.	PG	4151	R 103,105
Coil	320 mH	LB	0434	L 102,103
"	320 mH	LB	0435	L 101
FILTER 4 k c/s:				
Polystyrene	6.3 nF ± 5%/200 V	CT	3234	C 101-103
Trimmer pot.m.	300 kΩ lin.	PG	4301	R 101,104
"	500 kΩ lin.	PG	4502	R 102
"	150 kΩ lin.	PG	4151	R 103,105
Coil	250 mH	LB	0436	L 102,103
"	250 mH	LB	0437	L 101
FILTER 5 k c/s:				
Polystyrene	5 nF ± 5%/200 V	CT	3226	C 101-103
Trimmer pot.m.	300 kΩ lin.	PG	4301	R 101,104
"	500 kΩ lin.	PG	4502	R 102
"	150 kΩ lin.	PG	4151	R 103,105
Coil	200 mH	LB	0438	L 102,103
"	200 mH	LB	0439	L 101
FILTER 6.3 k c/s:				
Polystyrene	4 nF ± 5%/200 V	CT	3225	C 101-103
Trimmer, ceramic	10-40 pF/250 V	CV	0019	"C"
Trimmer pot.m.	300 kΩ lin.	PG	4301	R 101,104
"	500 kΩ lin.	PG	4502	R 102
"	150 kΩ lin.	PG	4151	R 103,105
Coil	144 mH	LB	0451	L 102,103
"	144 mH	LB	0452	L 101
FILTER 8 k c/s:				
Polystyrene	3.2 nF ± 5%/200 V	CT	3233	C 101-103
Trimmer, ceramic	10-40 pF/250 V	CV	0019	"C"
Trimmer pot.m.	300 kΩ lin.	PG	4301	R 101,104
"	500 kΩ lin.	PG	4502	R 102
"	150 kΩ lin.	PG	4151	R 103,105
Coil	113 mH	LB	0453	L 102,103
"	113 mH	LB	0454	L 101
FILTER 10 k c/s:				
Polystyrene	2.5 nF ± 5%/400 V	CT	3223	C 101-103
Trimmer, ceramic	10-40 pF/250 V	CV	0019	"C"
Trimmer pot.m.	300 kΩ lin.	PG	4301	R 101,104
"	500 kΩ lin.	PG	4502	R 102
"	150 kΩ lin.	PG	4151	R 103,105
Coil	90 mH	LB	0455	L 102,103
"	90 mH	LB	0456	L 101

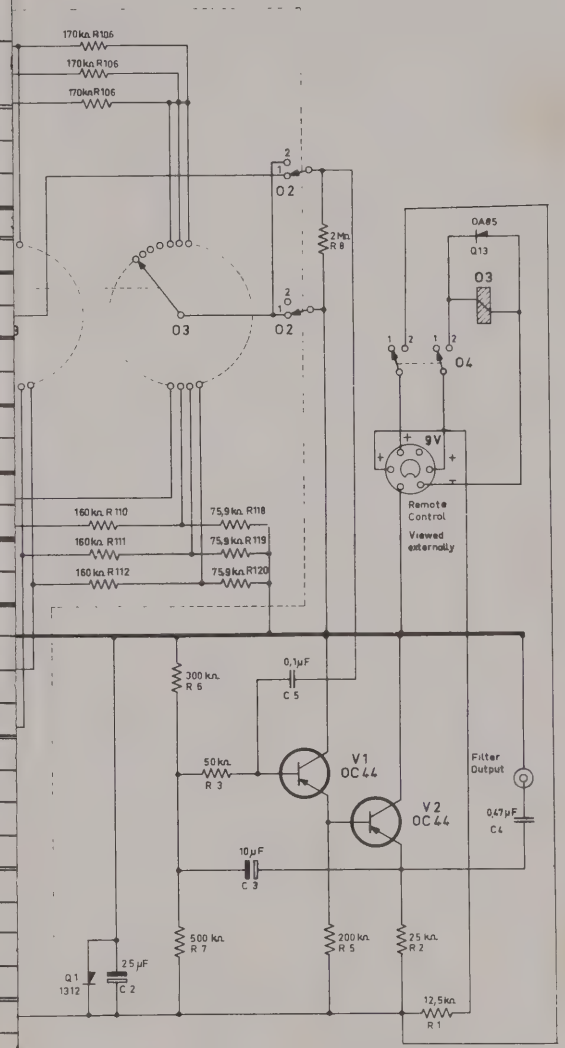
COMPONENT TYPE		STOCK REFERENCE		CIRCUIT DIAGRAM
FILTER 12.5 k c/s:				
Polystyrene	2 nF ± 5%/400 V	CT	3222	C 101-103
Trimmer, ceramic	10-40 pF/250 V	CV	0019	"C"
Trimmer pot.m.	300 kΩ lin.	PG	4301	R 101,104
"	500 kΩ lin.	PG	4502	R 102
"	150 kΩ lin.	PG	4151	R 103,105
Coil	71.5 mH	LB	0557	L 102,103
"	71.5 mH	LB	0558	L 101
FILTER 16 k c/s:				
Polystyrene	1.6 nF ± 5%/400 V	CT	3232	C 101-103
Trimmer, ceramic	10-40pF/250 V	CV	0019	"C"
Trimmer pot.m.	300 kΩ lin.	PG	4301	R 101,104
"	500 kΩ lin.	PG	4502	R 102
"	150 kΩ lin.	PG	4151	R 103,105
Coil	56.8 mH	LB	0459	L 103
"	55.5 mH	LB	0460	L 102
FILTER 20 k c/s:				
Polystyrene	1.25 nF ± 5%/400 V	CT	3219	C 101-103
Trimmer, ceramic	10-40pF/250 V	CV	0019	"C"
Trimmer pot.m.	300 kΩ lin.	PG	4301	R 101,104
"	500 kΩ lin.	PG	4502	R 102
"	150 kΩ lin.	PG	4151	R 103,105
Coil	45.1 mH	LB	0462	L 103
"	44.1 mH	LB	0463	L 102
"	45.1 mH	LB	0464	L 101
FILTER 25 k c/s:				
Polystyrene	1 nF ± 5%/500 V	CT	0118	C 101-103
Trimmer, ceramic	10-40pF/250 V	CV	0019	"C"
Trimmer pot.m.	300 kΩ lin.	PG	4301	R 101,104
"	500 kΩ lin.	PG	4502	R 102
"	150 kΩ lin.	PG	4151	R 103,105
Coil	35.8 mH	LB	0465	L 103
"	34.8 mH	LB	0466	L 102
"	35.8 mH	LB	0467	L 101
FILTER 31.5 k c/s:				
Polystyrene	0.8 nF ± 5%/500 V	CT	0116	C 101-103
Trimmer, ceramic	10-40pF/250 V	CV	0019	"C"
Trimmer pot.m.	300 kΩ lin.	PG	4301	R 101,104
"	4	PG	4502	R 102
"	150 kΩ lin.	PG	4151	R 103,105
Coil	28.5 mH	LB	0468	L 103
"	27.8 mH	LB	0469	L 102
"	28.5 mH	LB	0470	L 101
FILTER 40 k c/s:				
Polystyrene	0.63 nF ± 5%/400 V	CT	3214	C 101-103
Trimmer, ceramic	10-40pF/250 V	CV	0019	"C"
Trimmer pot.m.	300 kΩ lin.	PG	4301	R 101,104
"	500 kΩ lin.	PG	4502	R 102
"	150 kΩ lin.	PG	4151	R 103,105
Coil	22.6 mH	LB	0471	L 103
"	21.6 mH	LB	0472	L 102
"	22.6 mH	LB	0473	L 101

BRÜEL & KJÆR
Nærum - Denmark

Circuit Diagram

valid from serial no. 64072

Filter No.	Frequency c/s	L 101, 102 and 103 H	C 101–103 nF	R 101 kΩ	R 102 kΩ	R 103 kΩ
ZS 0146	12,5	80	2000			
	16	63	1600			
	20	50	1250			
ZS 0048	25	40	1000			
ZS 0049	31,5	31,5	800			
ZS 0029	40	25	630			
	50	20	500			
ZS 0030	63	16	400			
	80	12,5	315			
ZS 0031	100	10	250			300
	125	8	200			"
ZS 0032	160	6,3	160			"
	200	5	125	(800)		"
ZS 0150	250	4	100			"
	315	3,15	80			"
ZS 0151	400	2,5	63	1000		"
	500	2	50	500		"
	630	1,6	40	1000		"
	800	1,25	31,5	500		"
ZS 0152	1000	1,0	25	500		150
	1250	0,8	20	300	500	"
	1600	0,63	16	"	"	"
	2000	0,5	12,5	"	"	"
ZS 0153	2500	0,4	10	"	"	"
	3150	0,315	8	"	"	"
	4000	0,25	6,3	"	"	"
	5000	0,2	5	"	"	"
ZS 0039	6300	0,16	4	"	"	"
	8000	0,125	3,15	"	"	"
	10000	0,1	2,5	"	"	"
	12500	0,08	2	"	"	"
	16000	0,063	1,6	"	"	"
ZS 0142	20000	0,05	1,25	150	"	"
	25000	0,04	1,0	"	"	"
	31500	0,0315	0,8	"	"	"
	40000	0,025	0,63	"	"	"



O5: Weighting Network

1: Off
2: On

Brüel & Kjær
Copenhagen

Band-pass Filter Set
Type 1612

8.64

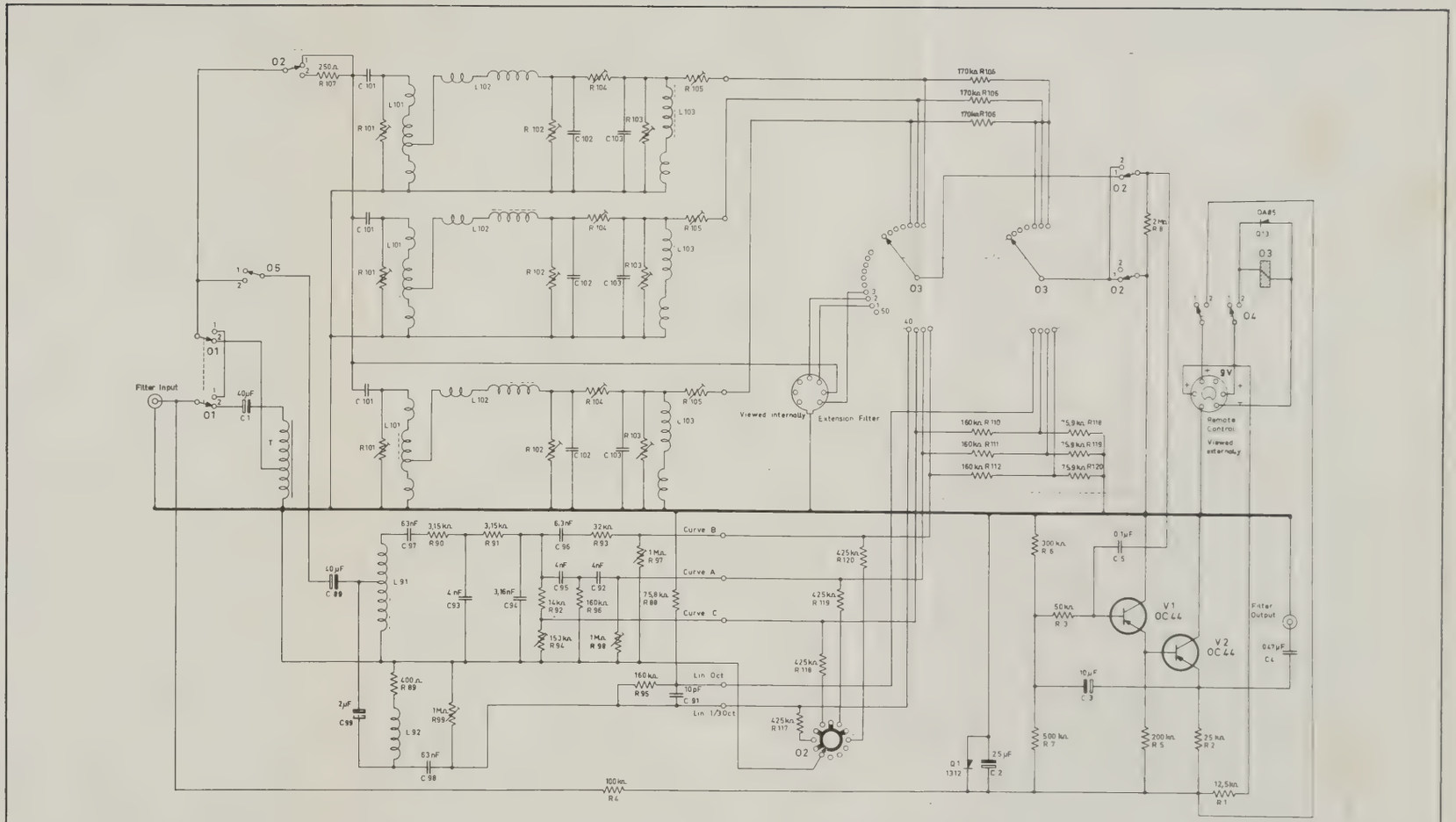
BRÜEL & KJÆR
Nærum - Denmark

Circuit Diagram

valid from serial no. 64072

1612.9

Filter No.	Frequency c/s	L 101, 102 and 103 H	C 101–103 nF	R 101 kΩ	R 102 kΩ	R 103 kΩ	R 104 kΩ	R 105 kΩ
ZS 0146	12,5	80	2000				250	300
	16	63	1600				"	"
	20	50	1250				"	"
ZS 0048	25	40	1000				300	"
ZS 0049	31,5	31,5	800				"	"
ZS 0029	40	25	630				"	"
	50	20	500				"	"
ZS 0030	63	16	400				"	150
	80	12,5	315				"	"
ZS 0031	100	10	250			300	"	"
	125	8	200			"	"	"
ZS 0032	160	6,3	160			"	"	"
	200	5	125	(800)		"	"	"
ZS 0150	250	4	100			"	"	"
	315	3,15	80			"	"	"
ZS 0151	400	2,5	63	1000		"	"	"
	500	2	50	500		"	"	"
	630	1,6	40	1000		"	"	"
	800	1,25	31,5	500		"	"	"
ZS 0152	1000	1,0	25	500		150	"	"
	1250	0,8	20	300	500	"	"	"
	1600	0,63	16	"	"	"	"	"
	2000	0,5	12,5	"	"	"	"	"
ZS 0153	2500	0,4	10	"	"	"	"	"
	3150	0,315	8	"	"	"	"	"
	4000	0,25	6,3	"	"	"	"	"
	5000	0,2	5	"	"	"	"	"
ZS 0039	6300	0,16	4	"	"	"	"	"
	8000	0,125	3,15	"	"	"	"	"
	10000	0,1	2,5	"	"	"	"	"
	12500	0,08	2	"	"	"	"	"
	16000	0,063	1,6	"	"	"	"	"
ZS 0142	20000	0,05	1,25	150	"	"	"	"
	25000	0,04	1,0	"	"	"	"	"
	31500	0,0315	0,8	"	"	"	"	"
	40000	0,025	0,63	"	"	"	"	"



01: Input Switch
1: Direct
2: Transformer

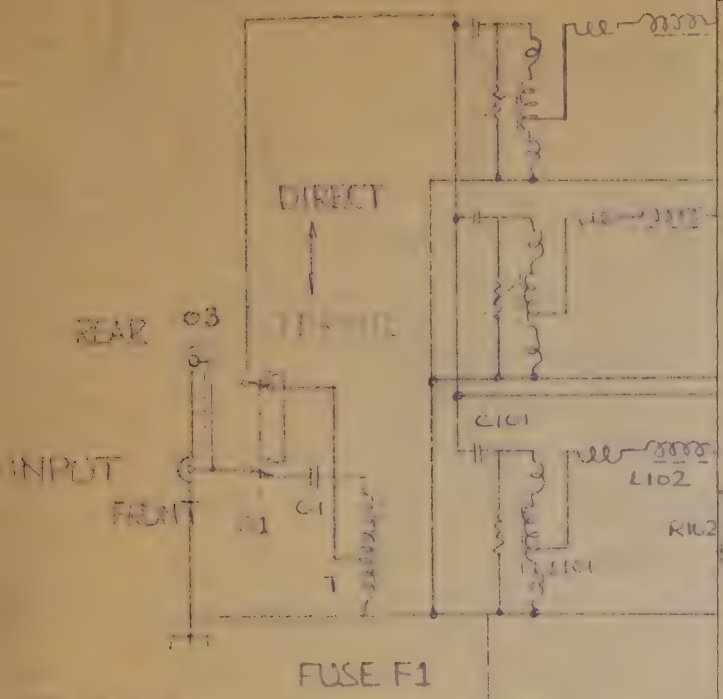
02: Function Selector
1: 1/3 Octave 0 db
2: Octave −10 db

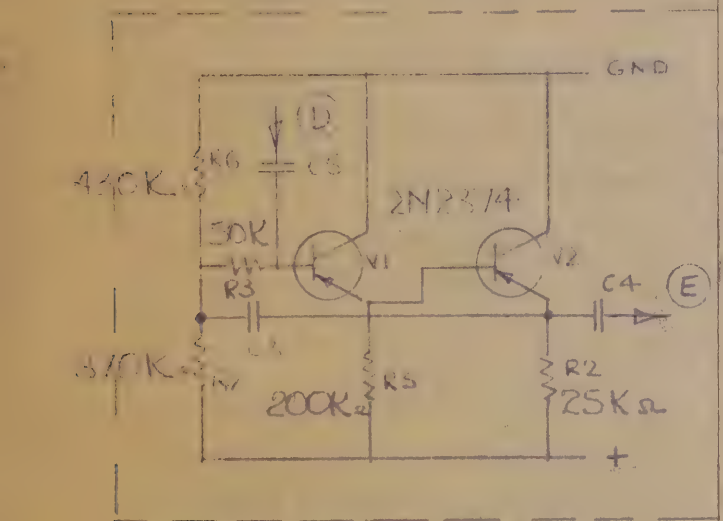
03: Filter Switch
1-3 Extension Filters
4-36: 1/3 Octave or Octave Filters
37-40 Weighting Network
41-50 Ground

04: Automatic Switching
1 Off
2 On

05: Weighting Network
1 Off
2 On

25-5-61	64072			Brüel & Kjær Copenhagen
5-12-61	77518			Band-pass Filter Set Type 1612
7-4-63	107296			





DETAILS OF AMPLIFIER "A"

250	630	400	25	40	315
315	800	500	31.5	50	25
125	200	8K	12.5K	20K	40K

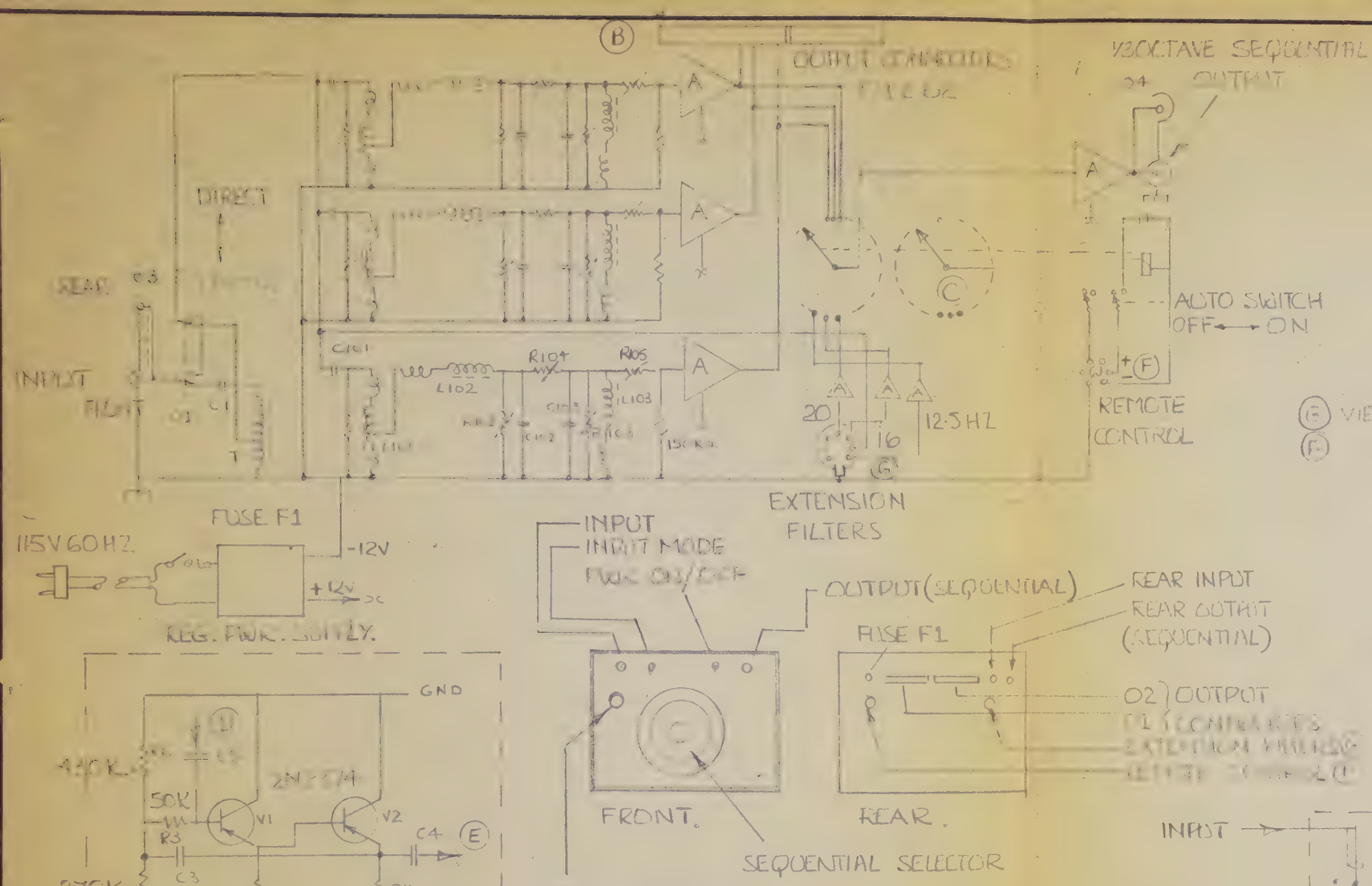
POSITION OF IMPEDANCE MATCH
VIEWED FROM THE TOP OF THE

REVISIONS		
DESCRIPTION	DATE	APPROVAL
DETAIL (B)		

CONNECTOR 01		CONNECTOR 02	
FREQ	PIN	FREQ	PIN
12.5	1	4000	1
16.	27	5000	3
20	3	6300	5
25	29	8000	7
31.	5	10K	9
40	31	12.5K	11
50	7	16 K	13
63	32	20K	15
80	9	25K	17
100	35	31.5K	19
125	11	40 K	21
160	37		
200	13		
250	39	GROUND IS	
315	15	CALLED ON	
400	41	C1 - PIN 50 &	
500	17	C2 - PIN 25	
630	43		
800	19		
1000	45		
1250	21		
1600	47		
2000	23		
2500	48		
3150	25		

(C) SWITCH SECTION ORIGINALLY USE FOR 1 OCTAVE OPERATION IN 1612 NOT USED IN 1612 SIA

NEXT ASS'Y	S.O.	
DIAGRAM & DETAILS B&K IA PANELS	B & K INSTRUMENTS, INC. CLEVELAND, OHIO 44142	
DRAWN DATE 8-29-67	SIZE	DRAWING NUMBER / ISSUE
CHECKED DATE 10-10-67	B	SR 402 / 2
DATE		



CONNECTOR C1		CONNECTOR C2	
FREQ	PIN	FREQ	PIN
12.5	1	4000	1
16.	27	5000	3
20	3	6300	5
25	29	8000	7
31.	5	10K	9
40	31	12.5K	11
50	7	16K	13
63	33	20K	15
80	9	25K	17
100	35	31.5K	19
125	11	40K	21
160	37		
200	13		
250	39	GROUND IS	
315	15	CARRIED ON	
400	41	C1 - PINS 20 &	
500	17	C2 - PINS 25	
630	43		
800	19		
1000	45		
1250	21		
1600	47		
2000	23		
2500	49		
3150	25		

NOTES (D) & (E) CAPACITOR VALUES CHANGE WITH FREQUENCY:

C4	C5	FREQ
10.	0.1	12.5 - 50 HZ
2	.01	[illegible]
.05	.001	2 - 40 KHZ

250	630	160	25	40	100	160	12.5K	20
315	500	800	31.5	50	25K	5K	1000	16
125	200	8K	12.5K	20K	40K	25K	63	80

FRONT
CENTER FREQ IN HZ.
REAR

POSITION OF IMPEDANCE MATCHING AMPLIFIERS VIEWED FROM THE TOP OF THE 1612 S1A

(E) PC BOARD COMPONENT LAYOUT LOOKING AT TOP OF BOARD (AMPLIFIER 'A')

(C) SWITCH SECTION DRAWINGS USE FOR 1/1 OCTAVE ORDINAL IN 1612 NOT USED IN 1612 S1A

2030L

REVISIONS

SYM	DESCRIPTION	DATE	APPROVAL
	DETAIL (B)		

SCALE	NEXT ASS'Y	S.O.	
TITLE CIRCUIT DIAGRAM & CONNECTOR DETAILS B&K MODEL 1612 S1A PARALLEL FILTER SET.		B & K INSTRUMENTS, INC. CLEVELAND, OHIO 44142	
DRAWN JW DATE 8-29-67		SIZE	DRAWING NUMBER / ISSUE
CHECKED 1-2 JW DATE 16-10-67		B	SK 462 / 2
APPROVED DATE			

MODEL 1612/S2L SPECTRUM SHAPER

General

The Model 1612/S2L Spectrum Shaper is a 36 channel 1/3 octave parallel filter which can separate the components of a complex signal into 36 one-third octave bands in the frequency range from 11 Hz to 45KHz. The separated signals are then individually adjusted in amplitude and re-combined to create a shaped passband. Thirty-three filters are contained in the 1612S2L and cover the frequency range from 25 to 40,000Hz. A rear connector allows the Bruel & Kjaer 1620 Extension Filter Set to be added to provide center frequencies at 12.5, 16 and 20Hz.

Component Parts

The 1612S2L Spectrum Shaper consists of:

1 - 1612S1A Parallel Filter Set
1 - 1612S2L-SP Shaping Panel
1 - 1612S2L-MB Memory Bar
1 - CC1612S2L-01 Connecting Cable
1 - CC1612S2L-02 Connecting Cable
1 - CC1612S2L-TL Test Lead
1 - 1612 Accessory Kit

1612S1A Parallel Filter Set

The 1612S1A Parallel Filter Set which divides the input signal into separate 1/3 octave bands is fully described in the 1612S1A Manual.

1612S2L-SP Shaping Panel

The 1612S2LSP Shaping Panel has 36 linear motion logarithmic law

attenuators which are connected via two cables (CC1612S2L-01 & 02) to the 36 parallel outputs of the 1612S1A Parallel Filter Set.

The sliding tap on each attenuator is connected to a test point and also through a resistor to a summing point where the 36 attenuator outputs are re-combined. By adjusting the sliding tap, the contribution of any 1/3 octave band can be varied and the total passband can be shaped.

The test points permit the operator to measure the output of the attenuator in each channel and thus assess the spectrum shape.

The summed signal is severely attenuated by the summing circuit. An output amplifier is provided inside the 1612S2L-SP which amplifies the summed signal and establishes unity gain through the spectrum shaper. Both the summed and the amplified summed signal are available at BNC connectors on the rear of the 1612S2L-SP chassis.

Power for the output amplifier is supplied by an internal regulated D.C. supply.

The Memory Bar

Once a spectrum shape has been set up, the attenuator settings can be memorized for future use by mounting the 1612S2L-MB Memory Bar on the spectrum shaping panel, peeling back the plastic trim strip and adjusting the plastic rods so that they butt against the attenuator knobs. The plastic rods are then locked into position using the small set screws.

The memorized spectrum can be re-set by moving all attenuator controls to their full stroke away from the panel center line, attaching the Memory Bar and then moving all attenuator knobs until they butt against the plastic rods. Note that the Memory Bar has different screw sizes at the left and right hand sides. This avoids inadvertant reversal during mounting.

Adjacent Channel Effects

The passbands of adjacent 1/3 octave channels intersect at the -3dB points. For any specific frequency, the signal which reaches the summing circuit is the algebraic sum of the signal amplitude due to the corresponding 1/3 octave attenuator setting and signals from adjacent filters which are more or less attenuated by the filter skirts and the adjacent channel attenuator settings. This effect is quite noticeable when the 1612S2L is set up for a single 1/3 octave maximum notch. At full attenuation the notch is approximately 15dB deep. A further 15dB can be obtained by setting the notch attenuator just above maximum attenuation, thus, "bucking out" some of the adjacent channel signal. See Figures 9 and 10.

Using the 1612S2L Spectrum Shaper

(a) Shaping the Spectrum

The 1612S2L Spectrum Shaper is used with other instruments to modify their frequency response characteristics. SK-463 shows a typical arrangement in which the 1612S2L is used with a Bruel & Kjaer Model 2603 Microphone Amplifier (Fig. 1). The input impedance of the 1612S2L demands a low impedance signal source and this is correctly provided by the external filter connection of the 2603. In normal operation, the output of the 1612S2L is connected back into the output amplifier of the 2603.

When setting up the spectrum shaper, the connections are re-arranged as shown in Fig. 2. The 2603 Input Amplifier is used to drive the 1612S2L Spectrum Shaper and the output amplifier and voltmeter circuit is used to measure the signal amplitude at the 36 test points.

An oscillator signal is applied to the 2603 input to give 1 volt RMS at the filter input. By switching from "external filter" to

"linear" on the 2603 Function Switch the input can be readily measured without disconnecting the test set up. With the meter multiplier switch on 0dB, 1 volt exists at the filter input when the 2603 meter reads full scale.

Using the external filter function and operating the meter multiplier at -20dB, the meter reads 1 volt RMS at full scale.

The oscillator is now set to the first filter center frequency and the 2603 Output Meter is patched to the corresponding test point and the attenuator is adjusted for the required level. The oscillator is re-set to the next center frequency and the process is repeated until all channels have been set. A second pass should then be made to make final adjustments.

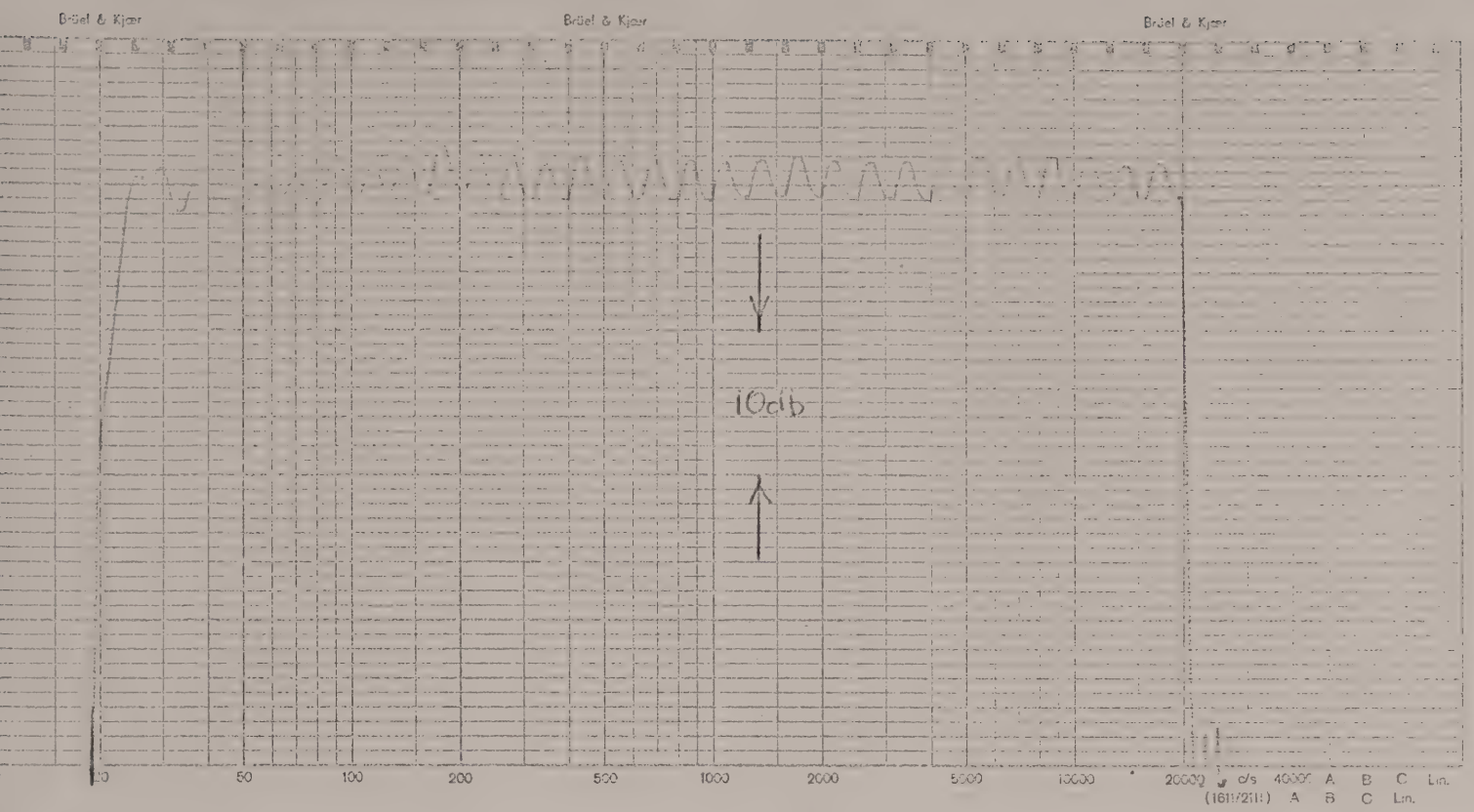


FIG. 8 - PASS BAND CHARACTERISTICS OF 1612/S2L
WITH ALL CHANNELS SET TO MINIMUM ATTENUATION

FIG. 9 - PASS BAND CHARACTERISTICS WITH 100, 1000 & 10,000 Hz
ATTENUATORS SET TO MAXIMUM ATTENUATION

FIG. 10 - PASS BAND CHARACTERISTICS WITH 100, 1000 & 10,000 Hz ATTENUATORS ADJUSTED FOR MAXIMUM NOTCH

FIG. 11 - PASS BAND CHARACTERISTICS WITH 800, 1000 & 1250 Hz ATTENUATORS SET TO MAXIMUM ATTENUATION

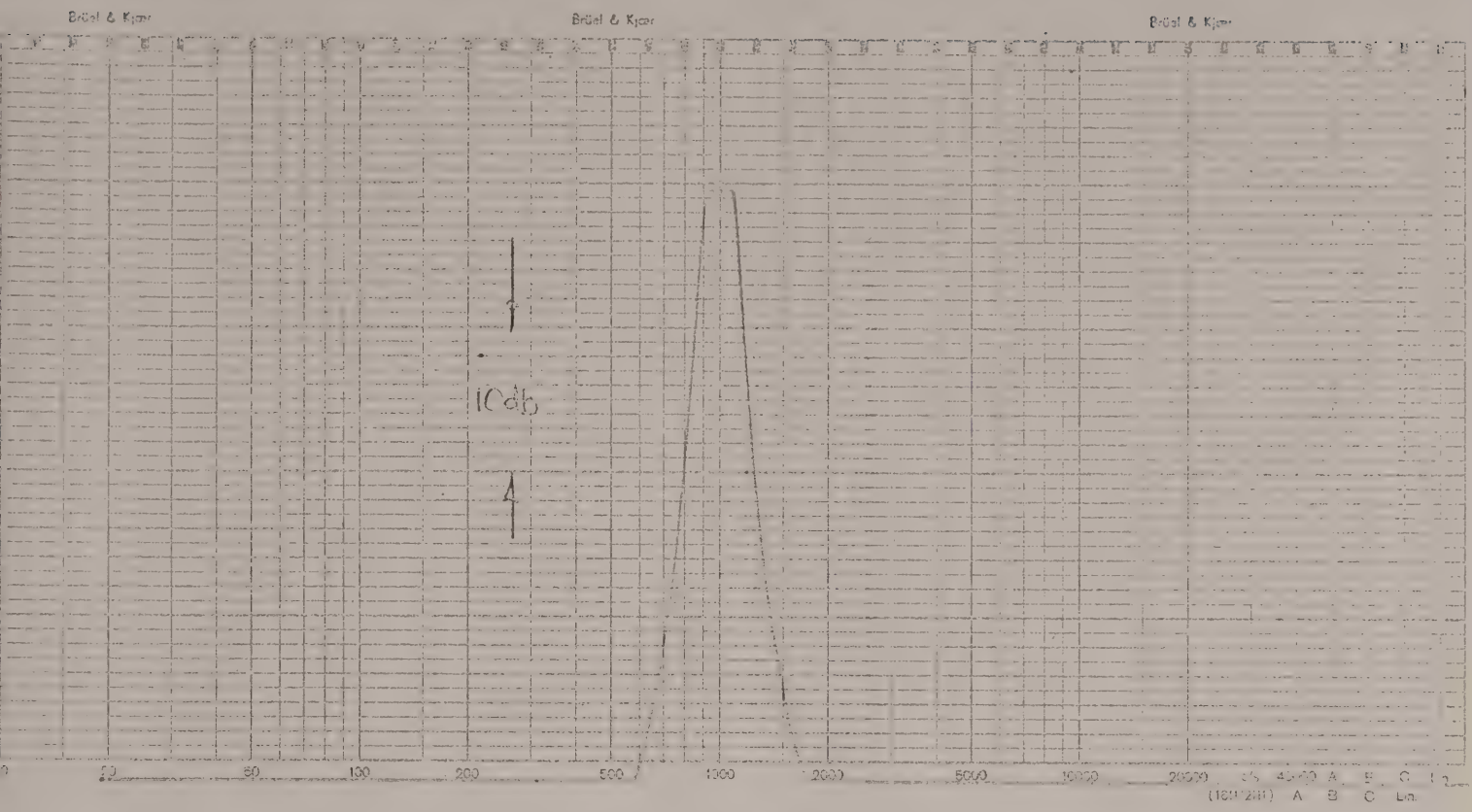
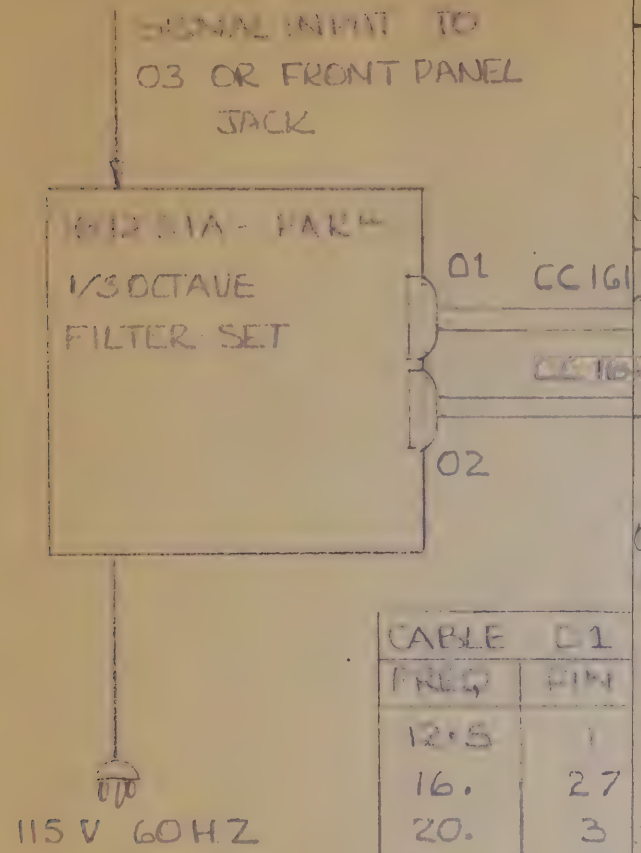


FIG. 12 - 1612/S2L WITH 1000 HZ SET TO MINIMUM ATTENUATION & ALL OTHER CHANNELS SET TO MAXIMUM ATTENUATION

FIG. 13 - 1612/S2L WITH 800, 1000 & 1250 HZ SET TO MINIMUM ATTENUATION & ALL OTHER CHANNELS SET TO MAXIMUM ATTENUATION



CABLE	C1
FREQ	PIN
12.5	1
16.	27
20.	3
25	29
31	5
40	31
50	7
63	33
80	9
100	35
125	11
160	37
200	13
250	39
315	15
400	41
500	17
630	43
800	19
1000	45
1250	21
1600	47
2000	23
2500	49
3150	25

REVISIONS

DESCRIPTION	DATE	APPROVAL

R11-1 THROUGH R11-36 ARE
IM RESISTOR WHICH SET THE
TTENUATION OF P_1 TO -20db AT
1D TRAVERSE

REF	COMPONENT
01	AMPHENOL 57-40500
02	" " 57-40500
C6-05	AMPHENOL UG 1094.
R11	SELECTED VALUES (NOTE B)
R12	IRC ½W 100KΩ 1%
R13	IRC ½W 500Ω 1%
R14	15K ½W IRC 1%
C1	CDE - CD15E 200J.
P1	GOTHAM 25KΩ AUDIOTAPER POT
P2	BOURNS 3067-1-203-20K.
S2	TRUCO 01-221
F2	LITTLE FUSE 3AG-542004
PS2	FERROTRAN MM15
A2	NEXUS FLA-L
TP1-36	CAMBION 4352-1-0310
P.CORD	BELDEN 17236-S
07	G-C-33-297-1BU.

EXT
SS'Y

S.O.

SP SPECTRUM
MING PANEL
462)

B & K INSTRUMENTS, INC.
CLEVELAND, OHIO 44142

DATE	SIZE	DRAWING NUMBER	ISSUE
DATE	B	SK463	1
DATE			

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL

SIGNAL INPUT TO
03 OR FRONT PANEL
JACK

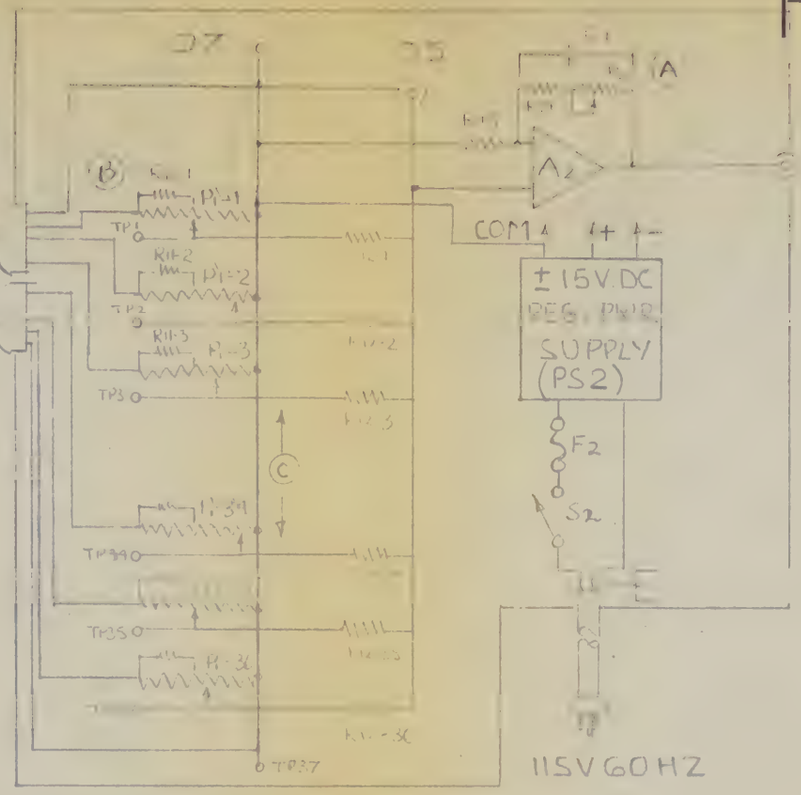
1612 S1A - PAR 4
1/3 OCTAVE
FILTER SET

01 CC1612S2L-01 01

CC1612S2L-02

02 02

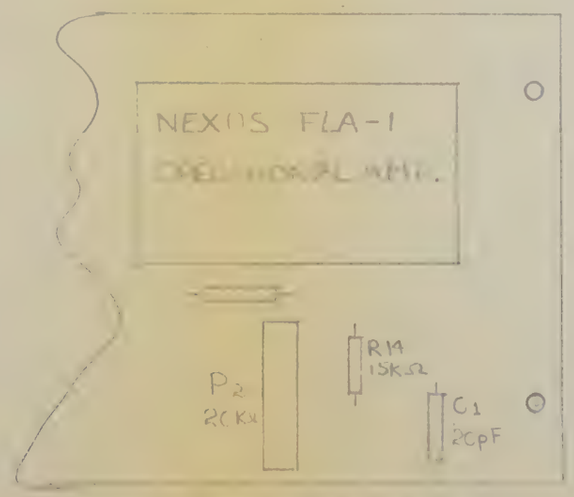
115 V 60 HZ



© CHANNELS 4-33 NOT SHOWN

CABLE 01		CABLE 02	
FREQ	PIN	FREQ	PIN
12.5	1	400	1
16	27	5000	3
20	2	6300	5
25	29	8000	7
31	5	10K	9
40	31	12.5K	11
50	7	16K	13
63	33	20K	15
80	9	25K	17
100	35	31.5K	19
125	11	40K	21
160	37		
200	13		
250	39		
315	15		
400	41		
500	17		
630	43		
800	19		
1000	45		
1250	21		
1600	47		
2000	23		
2500	49		
3150	25		

SIGNAL GROUND IS CARRIED ON 01 PIN 50 & 02 PIN 25. SIGNAL GROUND IS NOT CONNECTED TO CHASSIS GROUND



DETAIL A - COMPONENT LAYOUT

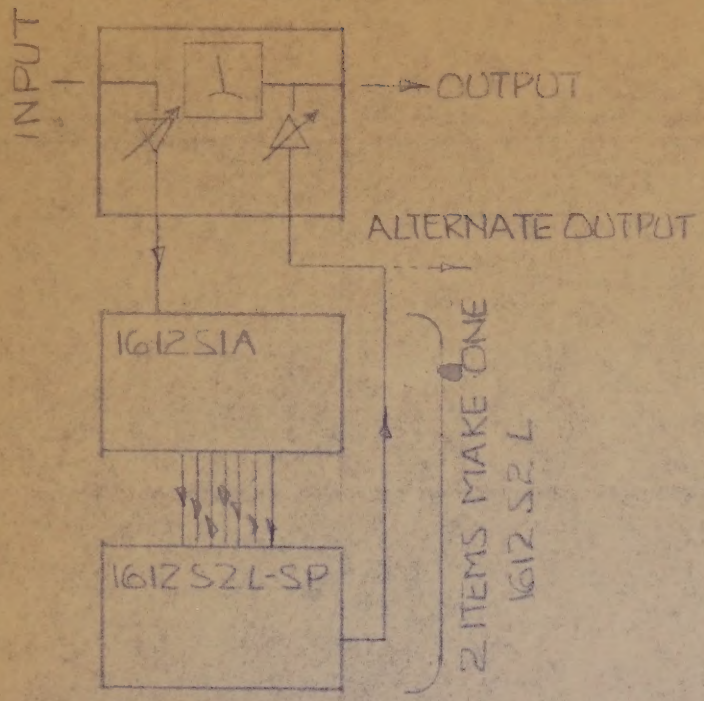
(B) R11-1 THROUGH R11-36 ARE TRIM RESISTOR WHICH SET THE ATTENUATION OF P1 TO -20db AT MID TRAVERSE

REF	COMPONENT
01	AMPHENOL 57-40500
02	-"- 57-40500
06-05	AMPHENOL UG1094.
R11	SELECTED VALUES (NOTE B)
R12	IRC ½W 100KΩ 1%
R13	IRC ½W 500Ω 1%
R14	15K 2W IRC 1%
C1	CDE - CD15E 200J.
P1	GOTHAM 25KΩ ROTATEK 101
P2	BOURNS 3067-1-203-20K.
S2	TRUCO 01-221
F2	LITTLE FUSE 3AG-542004
PS2	FERROTRAN MM15
A2	NEXUS FLA-L
TP1-36	CAMBION 4352-1-0310
P.CORD	BELDEN 17236-S
07	G-C-33-297-1BU.

SCALE	NEXT ASS'Y	S.O.	
TITLE 1612S2L-SP SPECTRUM SHAPING SUMMING PANEL (READ WITH SK462)		B & K INSTRUMENTS, INC. CLEVELAND, OHIO 44142	
DRAWN JWJ	DATE 30-8-67	SIZE	DRAWING NUMBER / ISSUE
CHECKED	DATE	B	SK463 / 1
APPROVED	DATE		

BEK 2603 MIC AMPLIFIER.

FIG 1



INSTRUMENT INTER-CONNECTION FOR NORMAL OPERATION

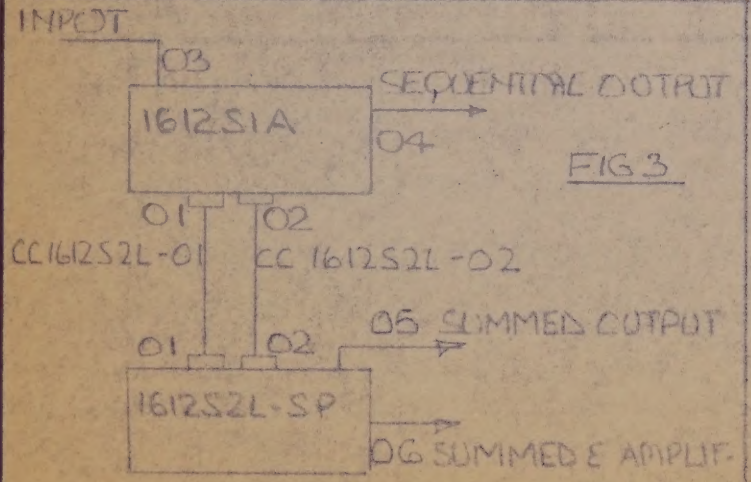
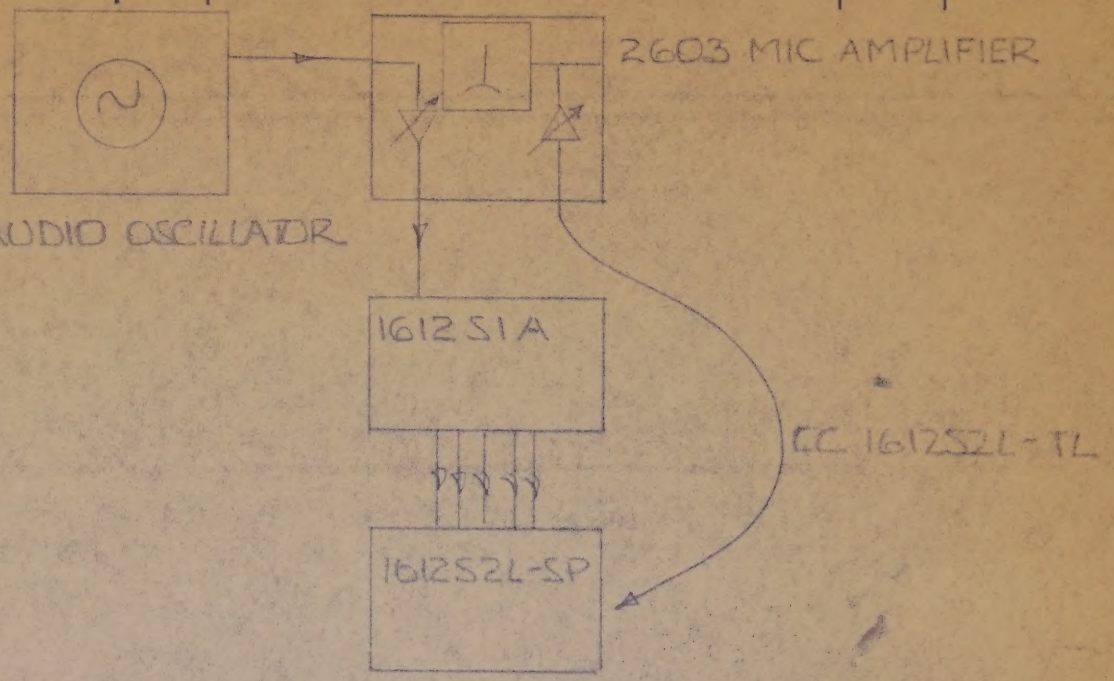


FIG 3

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL



INSTRUMENT INTER-CONNECTION FOR SETTING A SPECTRUM SHAPE

FIG 2.

SCALE	NEXT ASS'Y	S.O.
TITLE INTERCONNECTIONS OF 1612S1A & 1612S2L-SP FOR NORMAL USE & SETUP		B & K INSTRUMENTS, INC. CLEVELAND, OHIO 44142
DRAWN JW DATE 30-8-67	SIZE A	DRAWING NUMBER SK 467 ISSUE 1
CHECKED DATE		
APPROVED DATE		